DATAKOM

KG-545

AUTOMATIC MAINS FAILURE UNIT

FEATURES

Automatic mains failure
Engine control
Generator protection
Built in alarms and warning
Manual control enabled
Magnetic pickup input
Dual genset mutual standby operation
Load shedding, dummy load
Gas engine support
Engine idle speed control
True RMS measurements
3 phase mains voltage inputs
3 phase genset voltage inputs
3 phase genset/load CT inputs
Engine oil pressure measurement
Engine coolant temperature measurement
Fuel level measurement
Oil temperature measurement
Canopy temperature measurement
Canopy temperature measurement
Genset active power measurement
Genset power factor measurement
Engine rpm display
Periodic maintenance request indicator
Engine hours counter
Event logging with date-time stamp and complete measurement values
Remote Panel Feature
4-20mA Oil pressure measurement
Stores last 100 events
Statistical counters
Battery backed-up real time clock
3 level password protection
Programmable parameters
Return to factory settings enabled
RS-232/ RS-485 selectable serial port
Firmware downloadable from serial port
Free MS-Windows Remote monitoring SW:
-local and modem connection
-monitoring, download of parameters
-networking via modems
GSM and PSTN modem support
GSM-SMS sending on fault
Modem calls on fault
MODBUS communication
128x64 graphic LCD display
Multiple language support
Customer logo display
Analogue inputs: 5
Digital inputs: 9
Digital outputs: 7
Input / output expansion capability
Remote Start operation available
Engine Idle speed control
Survives cranking dropouts
Sealed front panel
Plug-in connection system for easy replacement
Dimensions (202x148x48mm)

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ABOUT THIS DOCUMENT

This document describes minimum requirements and necessary steps for the successful installation of the KG-545 family units.

Follow carefully advices given in the document. These are often good practices for the installation of genset control units which reduce future issues.

For all technical queries please contact Datakom at below e-mail address:

datakom@datakom.com.tr

RELATED DOCUMENTS

FILENAME	DESCRIPTION
MODBUS_FOR_545.pdf	KG-545 Modbus Manual
DUAL-GENSET-APPLICATION.pdf	Dual Genset Mutual Standby Application Guide
appnote-545-firmware download.pdf	Firmware Download Guide

REVISION HISTORY

REVISION	DATE	AUTHOR	DESCRIPTION
01	23.03.2012	MH	First issue, firmware version 11

TERMINOLOGY

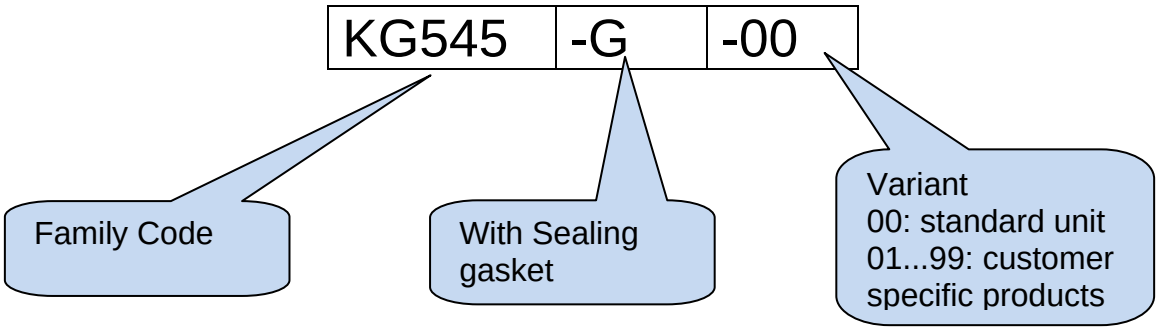
CAUTION: Potential risk of injury or death.

WARNING: Potential risk of malfunction or material damage.

ATTENTION: Useful hints for the understanding of device operation.

ORDERING CODES

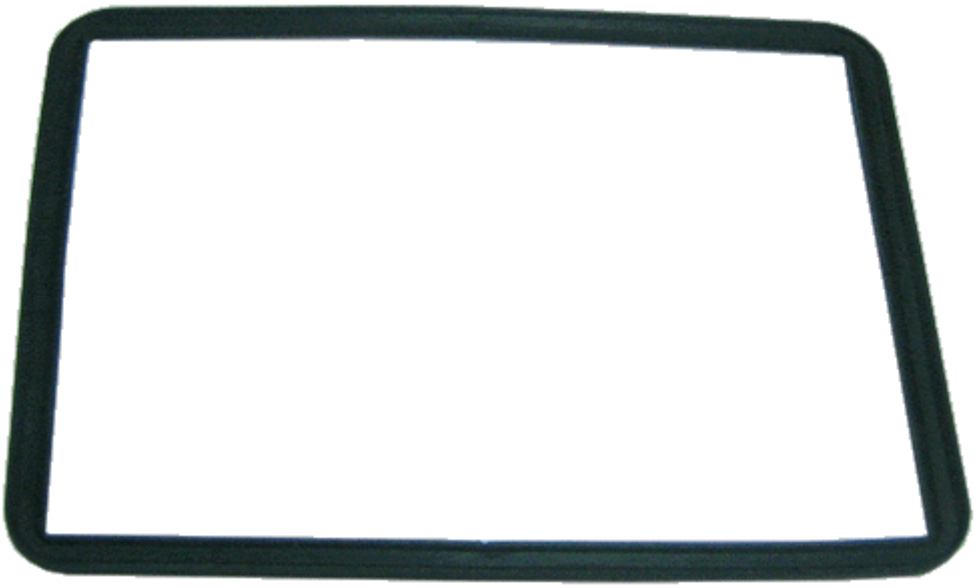
The D-500 family units are available in various options and peripheral features. Please use below information for ordering the correct version:



SPARE PARTS

Screw type bracket
Stock Code=J10P01 (per unit)

Self Retaining type bracket
Stock Code=K16P01 (per unit)



Sealing Gasket
Stock Code= J46P02

SAFETY NOTICE

Failure to follow below instructions will result in death or serious injury

- **Electrical equipment should be installed only by qualified specialist. No responsibility is assured by the manufacturer or any of its subsidiaries for any consequences resulting from the non-compliance to these instructions.**
- **Check the unit for cracks and damages due to transportation. Do not install damaged equipment.**
- **Do not open the unit. There are no serviceable parts inside.**
- **Fuses must be connected to the power supply and phase voltage inputs, in close proximity of the unit.**
- **Fuses must be of fast type (FF) with a maximum rating of 6A.**
- **Disconnect all power before working on equipment.**
- **When the unit is connected to the network do not touch terminals.**
- **Short circuit terminals of unused current transformers.**
- **Any electrical parameter applied to the device must be in the range specified in the user manual. Although the unit is designed with a wide safety margin, over-range parameters may reduce lifetime, alter operational precision or even damage the unit.**
- **Do not try to clean the device with solvent or the like. Only clean with a dump cloth.**
- **Verify correct terminal connections before applying power.**
- **Only for front panel mounting.**

Current Transformers must be used for current measurement.

No direct connection allowed.

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1. INSTALLATION INSTRUCTIONS

Before installation:

- Read the user manual carefully, determine the correct connection diagram.
- Remove all connectors and mounting brackets from the unit, then pass the unit through the mounting opening.
- Put mounting brackets and tighten. Do not tighten too much, this can brake the enclosure.
- Make electrical connections with plugs removed from sockets, then place plugs to their sockets.
- Be sure that adequate cooling is provided.
- Be sure that the temperature of the environment will not exceed the maximum operating temperature in any case.

Below conditions may damage the device:

- Incorrect connections.
- Incorrect power supply voltage.
- Voltage at measuring terminals beyond specified range.
- Voltage applied to digital inputs over specified range.
- Current at measuring terminals beyond specified range.
- Overload or short circuit at relay outputs
- Connecting or removing data terminals when the unit is powered-up.
- High voltage applied to communication ports.
- Ground potential differences at non-isolated communication ports.
- Excessive vibration, direct installation on vibrating parts.

Current Transformers must be used for current measurement.

No direct connection allowed.

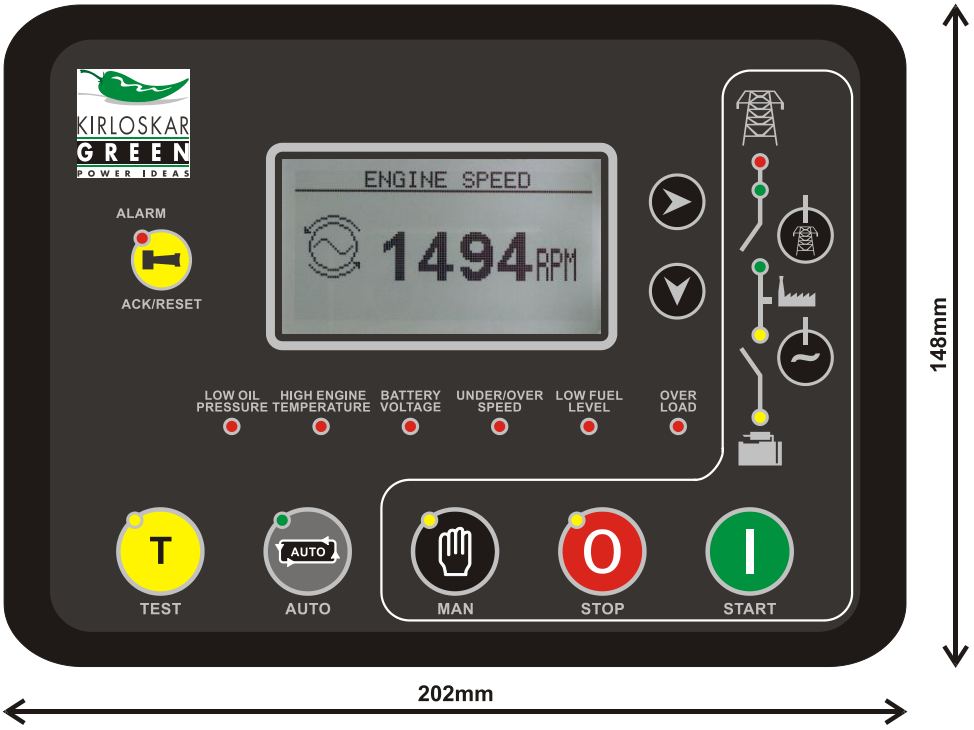
Below conditions may cause abnormal operation:

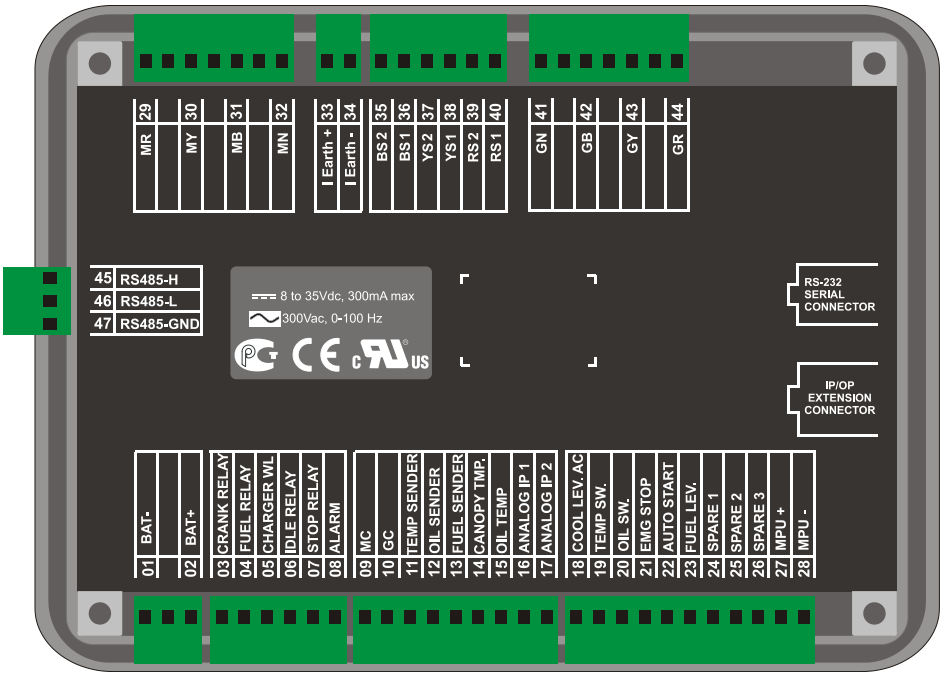
- Power supply voltage below minimum acceptable level.
- Power supply frequency out of specified limits
- Phase order of voltage inputs not correct.
- Current transformers not matching related phases.
- Current transformer polarity incorrect.
- Missing grounding.

2. MOUNTING

2.1. DIMENSIONS

Dimensions: 202x148x48mm (7.95”x5.8”x1.9”)
Panel Cutout: 183x134mm minimum (7.2”x5.3”)
Weight: 400g (1 lb)

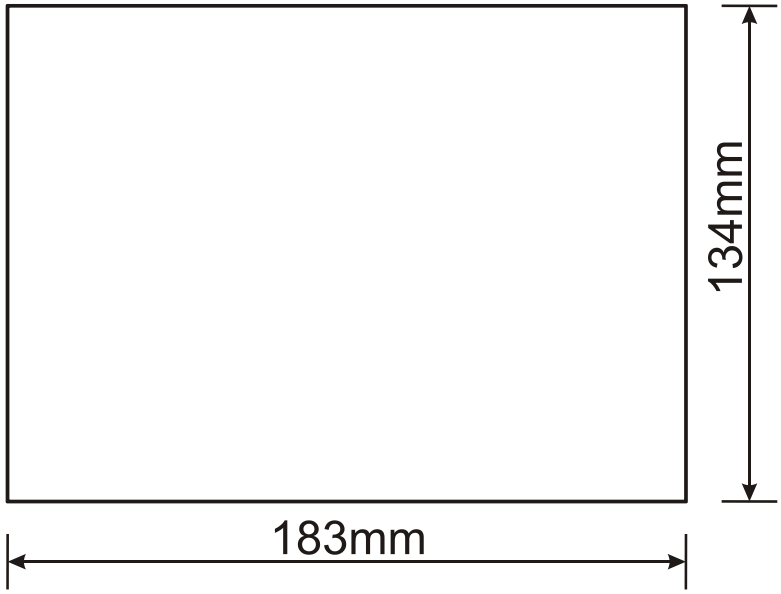




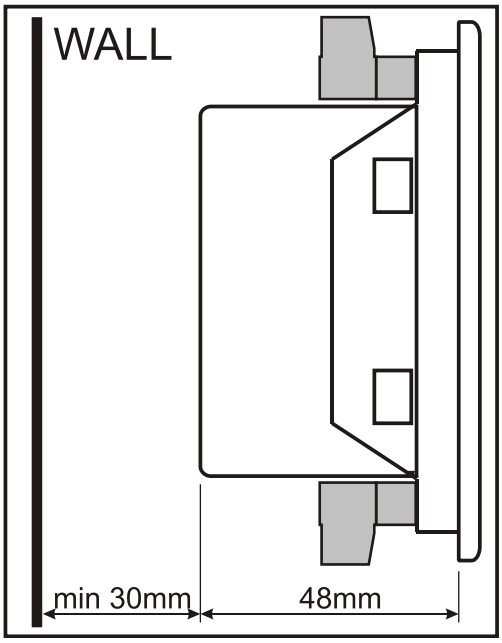
The unit is designed for panel mounting. The user should not be able to access parts of the unit other than the front panel.

Mount the unit on a flat, vertical surface. Before mounting, remove the mounting brackets and connectors from the unit, then pass the unit through the mounting opening.

Place and tighten mounting brackets.



Panel Cutout



Required Panel Depth

Two different types of brackets are provided:

Screw type bracket

Self retaining type bracket

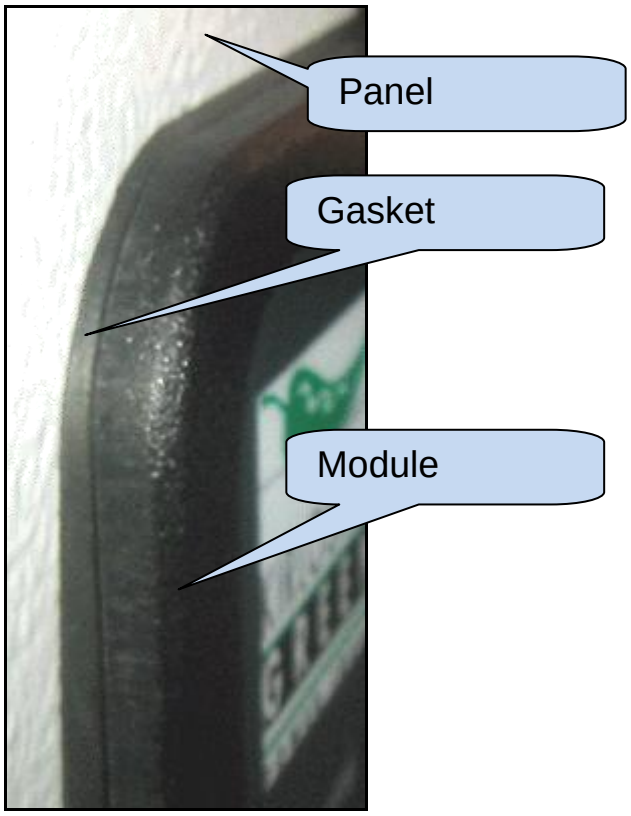
Installation of screw type bracket

Installation of self retaining type bracket

Do not tighten too much, this may break the unit.

2.2. SEALING, GASKET

The rubber gasket provides a watertight means of mounting the module to the genset panel. Together with the gasket, IEC 60529-IP65 protection can be reached from the front panel. A short definition of IP protection levels is given below.



1st Digit
0 Not protected
1 Protected against solid foreign objects of 50 mm diameter and greater
2 Protected against solid foreign objects of 12,5 mm diameter and greater
3 Protected against solid foreign objects of 2,5 mm diameter and greater
4 Protected against solid foreign objects of 1,0 mm diameter and greater
5 Protected from the amount of dust that would interfere with normal operation
6 Dust tight

2nd Digit
0 Not protected
1 Protected against vertically falling water drops
2 Protected against vertically falling water drops when enclosure is tilted up to 15 °
3 Protected against water sprayed at an angle up to 60 ° on either side of the vertical
4 Protected against water splashed against the component from any direction
5 Protected against water projected in jets from any direction
6 Protected against water projected in powerful jets from any direction
7 Protected against temporary immersion in water
8 Protected against continuous immersion in water, or as specified by the user

2.3. ELECTRICAL INSTALLATION

Do not install the unit close to high electromagnetic noise emitting devices like contactors, high current busbars, switchmode power supplies and the like.

Although the unit is protected against electromagnetic disturbance, excessive disturbance can affect the operation, measurement precision and data communication quality.

- **ALWAYS remove plug connectors when inserting wires with a screwdriver.**
- **Fuses must be connected to the power supply and phase voltage inputs, in close proximity of the unit.**
- **Fuses must be of fast type (FF) with a maximum rating of 6A.**
- **Use cables of appropriate temperature range.**
- **Use adequate cable section, at least 0.75mm^2 (AWG18).**
- **Follow national rules for electrical installation.**
- **Current transformers must have 5A output.**
- **For current transformer inputs, use at least 1.5mm^2 section (AWG15) cable.**
- **The current transformer cable length should not exceed 1.5 meters. If longer cable is used, increase the cable section proportionally.**

Current Transformers must be used for current measurement.

No direct connection allowed.

The engine body must be grounded. Otherwise faulty voltage and frequency measurements may occur.

For the correct operation of the exerciser and weekly schedule programs, adjust the real time clock of the unit through programming menu.

3. TERMINAL DESCRIPTIONS

3.1. BATTERY VOLTAGE INPUT

Supply voltage:	8 to 36VDC
Cranking dropouts:	Survives 0VDC during 100ms. The voltage before surge should be 8VDC minimum
Overvoltage protection:	Withstands 150VDC continuously.
Reverse voltage:	-36VDC continuous
Maximum operating current:	250mA @ 12/24VDC. (All options included, digital outputs open.)
Typical operating current:	100mA @ 12/24VDC. (all options passive, digital outputs open)
Measurement range:	0 to 36VDC
Display resolution:	0.1VDC
Accuracy:	0.5% + 1 digit @ 24VDC

3.2. AC VOLTAGE INPUTS

Measurement method:	True RMS
Sampling rate:	1000 Hz
Input voltage range:	14 to 300 VAC
Minimum voltage for frequency detection:	15 VAC (Ph-N)
Measurement range:	0 to 330VAC ph-N (0 to 570VAC ph-ph)
Common mode offset:	max 100V between neutral and BAT-
Input impedance:	990 K-ohms
Display resolution:	1VDC
Accuracy:	0.5% + 1 digit @ 230VAC ph-N (±2VAC ph-N) 0.5% + 1 digit @ 400VAC ph-ph (±3VAC ph-ph)

Frequency range:	DC to 100Hz
Frequency display resolution:	0.1 Hz
Frequency accuracy:	0.2% + 1 digit (±0.1 Hz @ 50Hz)

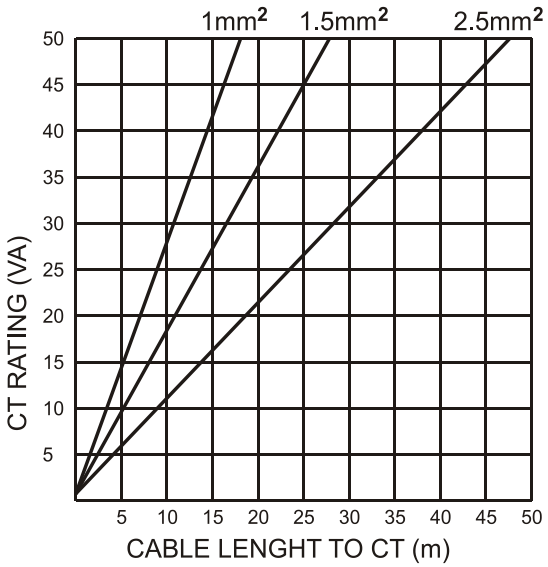
3.3. AC CURRENT INPUTS

Measurement method:	True RMS
Sampling rate:	1000 Hz
CT secondary rating:	5A
Measurement range:	5/5 to 5000/5A minimum
Input impedance:	15 mili-ohms
Burden:	0.375W
Maximum continuous current:	6A
Measurement range:	0.1 to 7.5A
Common mode offset:	Max 5VAC between BAT- and any CT terminal.
Display resolution:	1A
Accuracy:	0.5% + 1 digit @ 5A (± 4.5A @ 5/500A full range)

SELECTING THE CT RATING AND CABLE SECTION:

The load on a CT should be kept minimum in order to minimize phase shift effect of the current transformer. Phase shift in a CT will cause erroneous power and power factor readings, although amp readings are correct.

Datakom advises CT rating to be selected following this table for the best measurement accuracy.



SELECTING THE CT ACCURACY CLASS:

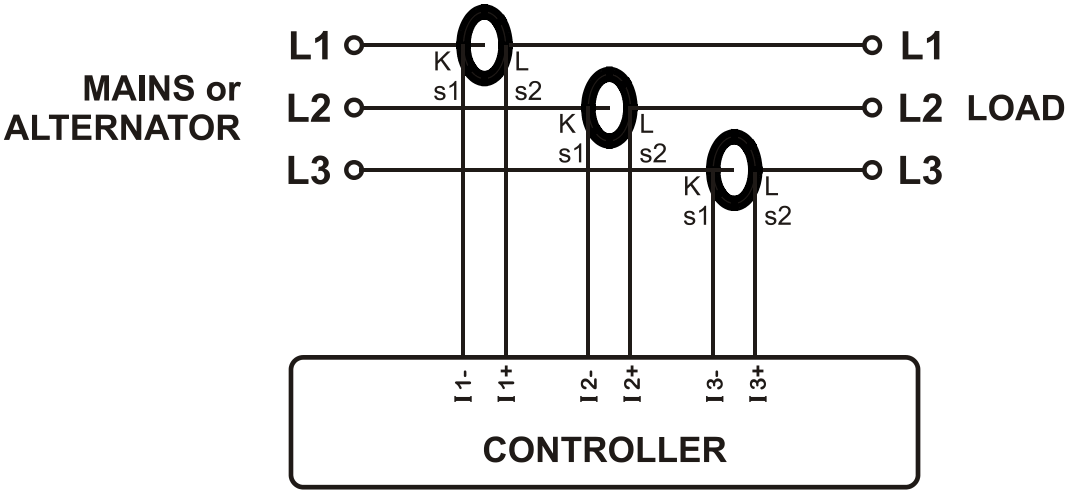
The CT accuracy class should be selected in accordance with the required measurement precision. The accuracy class of the Datakom controller is 0.5%. Thus 0.5% class CTs are advised for the best result.

CONNECTING CTs:

Be sure of connecting each CT to the related phase input with the correct polarity. Mixing CTs between phases will cause faulty power and pf readings.

Many combinations of incorrect CTs connections are possible, so check both order of CTs and their polarity. Reactive power measurement is affected by incorrect CTs connection in similar way as active power measurement.

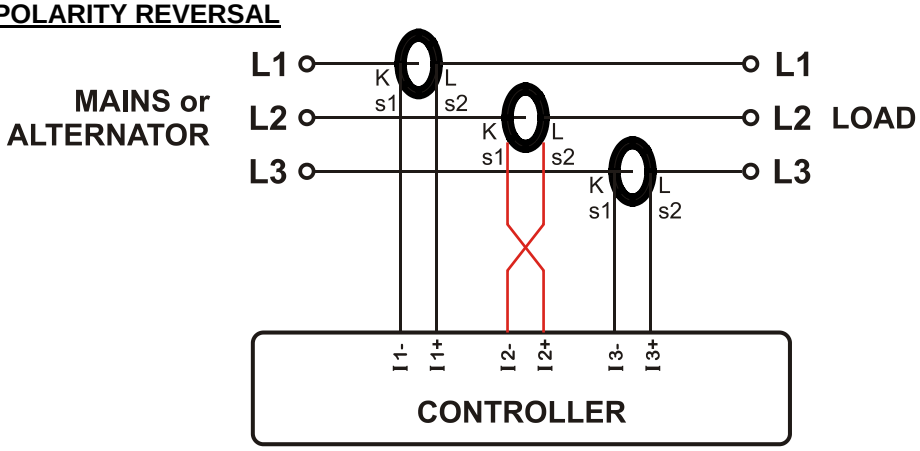
CORRECT CT CONNECTIONS



Let's suppose that the genset is loaded with 100 kW on each phase. The load Power Factor (PF) is 1. Measured values are as follows:

	kW	kVAr	kVA	pf
Phase L1	100.0	0.0	100	1.00
Phase L2	100.0	0.0	100	1.00
Phase L3	100.0	0.0	100	1.00
Total	**300.0**	**0.0**	**300**	**1.00**

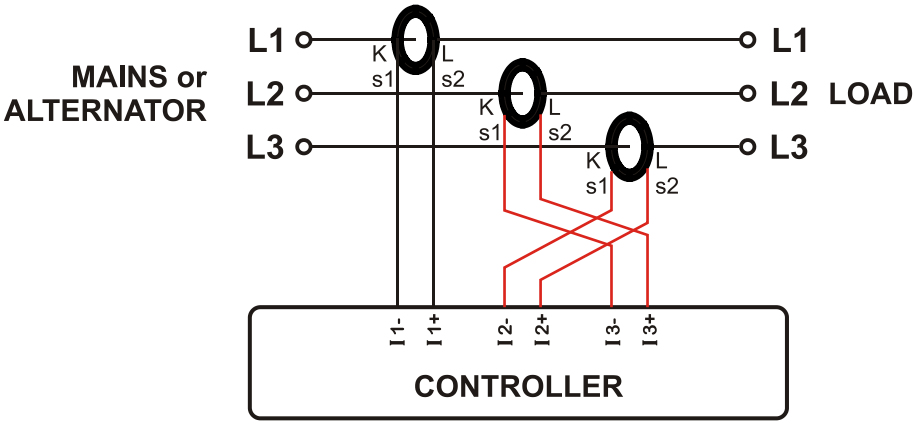
EFFECT OF POLARITY REVERSAL



The generator is still loaded with 100 kW On each phase. The load Power Factor (PF) is 1.
PF in phase L2 will show -1,00 due to reverse CT polarity. The result is that total generator power displayed by the controller is 100 kW.
Measured values are as follows:

	kW	kVAr	kVA	pf
Phase L1	100.0	0.0	100	1.00
Phase L2	-100.0	0.0	100	-1.00
Phase L3	100.0	0.0	100	1.00
Total	**100.0**	**0.0**	**300**	**0.33**

EFFECT OF PHASE SWAPPING



The generator is still loaded with 100 kW on each phase. The load Power Factor (PF) is 1.
PF in phases L2 and L3 will show -0,50 due to phase shift between voltages and currents which is caused by CT swapping. The result is that total generator power displayed by controller is 0 kW.
Measured values are as follows:

	kW	kVAr	kVA	pf
Phase L1	100.0	0.0	100	1.00
Phase L2	-50.0	86.6	100	-0.50
Phase L3	-50.0	-86.6	100	-0.50
Total	**0.0**	**0.0**	**300**	**0.0**

3.4. DIGITAL INPUTS

Number of inputs:	8 inputs, all configurable
Function selection:	from list
Contact type:	Normally open or normally closed (programmable)
Switching:	Battery negative or battery positive (programmable)
Structure:	47 k-ohms resistor to battery positive, 110k-ohms to battery negative.
Measurement:	Analog voltage measurement.
Open circuit voltage:	70% of battery voltage
Low level threshold:	35% of battery voltage
High level threshold:	85% of battery voltage
Maximum input voltage:	+100VDC with respect to battery negative
Minimum input voltage:	-70VDC with respect to battery negative
Noise filtering:	yes

3.5. ANALOG SENDER INPUTS AND SENDER GROUND

Number of inputs:	4 inputs, all configurable, additional sender ground input
Function selection:	from list
Structure:	667 ohms resistor polarizing to 3.3VDC
Measurement:	Analog resistor measurement.
Open circuit voltage:	+3.3VDC
Short circuit current:	5mA
Measurement range:	0 to 5000 ohms.
Open circuit threshold:	5000 ohms.
Resolution:	1 ohms @ 300 ohms or lower
Accuracy:	2 %+1 ohm (±7 ohms @300 ohms)
Common mode voltage range:	± 3VDC
Noise filtering:	yes

3.6. CHARGE INPUT TERMINAL

The Charge terminal is both an input and output.
When the engine is ready to run, this terminal supplies the excitation current to the charge alternator.
The excitation circuit is equivalent to a 2W lamp.
The threshold voltages for warning and shutdown alarm are adjustable through program parameter.

Structure:	□ battery voltage output through 20 ohm PTC □ voltage measurement input
Output current:	160mA @12VDC 80mA @24VDC
Voltage measurement resolution:	0.1VDC
Voltage measurement accuracy:	2% + 0.1V (0.9V @30VDC)
Charge Fail Warning Threshold:	adjustable
Charge Fail Shutdown Alarm Threshold:	adjustable
Open circuit voltage:	battery positive
Overvoltage protection:	> 500VDC continuous, with respect to battery negative
Reverse voltage protection:	-30VDC with respect to battery negative

3.7. MAGNETIC PICKUP INPUT

Structure:	Differential frequency measurement input
Input impedance:	50 k-ohms
Input voltage:	0.5VAC-RMS to 30VAC-RMS
Max common mode voltage:	± 5VDC
Frequency range:	10Hz to 10 kHz
Resolution:	1 rpm
Accuracy:	0.2% + 1 rpm (±3rpm @1500 rpm)
Flywheel teeth range:	1 to 500

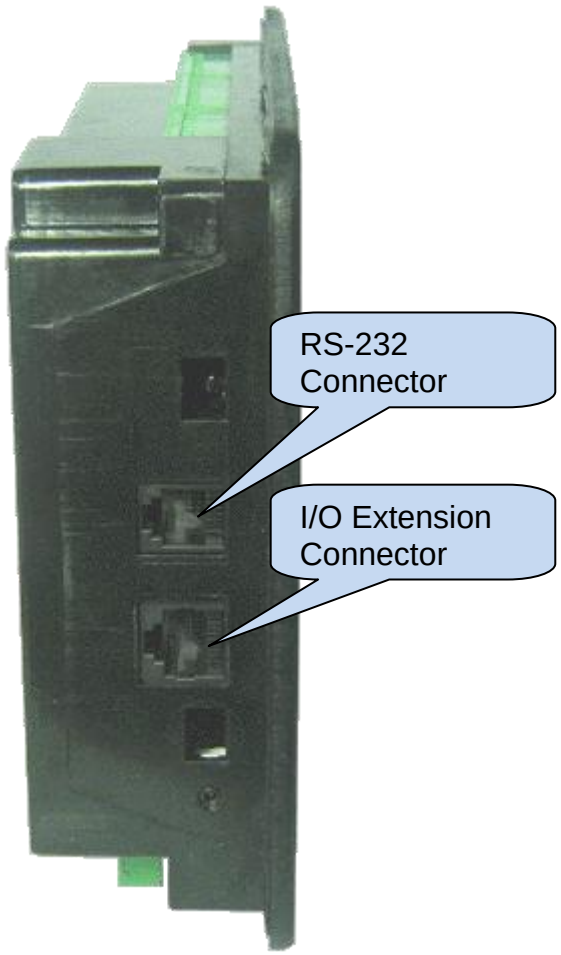
Do not share MPU with other devices.

3.8. DIGITAL OUTPUTS

The unit offers 6 digital outputs with programmable function, selectable from list.

Structure:	Negative pulling protected semiconductor output. One terminal is connected to battery negative.
Max continuous current:	1.0 ADC
Max switching voltage:	36 VDC
Overvoltage protection:	40 VDC
Short circuit protection:	> 1.7 ADC
Reverse voltage protection:	500 VDC

3.9. INPUT/OUTPUT EXTENSION

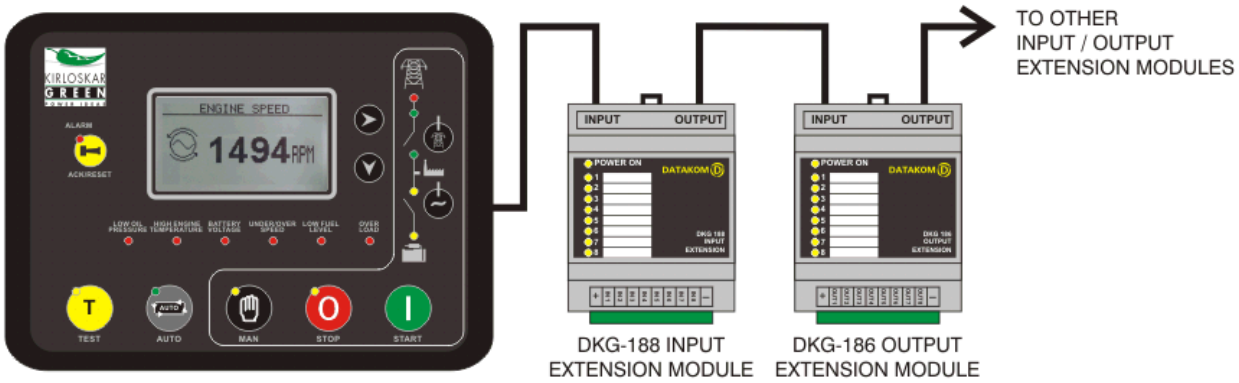


The module provides resources for 16 additional digital inputs and 16 additional digital outputs.

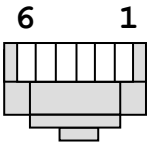
Digital inputs can be extended using **DKG-188 Digital Input Extension** modules, each one providing 8 inputs. Digital inputs are programmable through the main controller. The switching characteristic is not programmable and must be battery negative. Any function can be assigned to digital inputs.

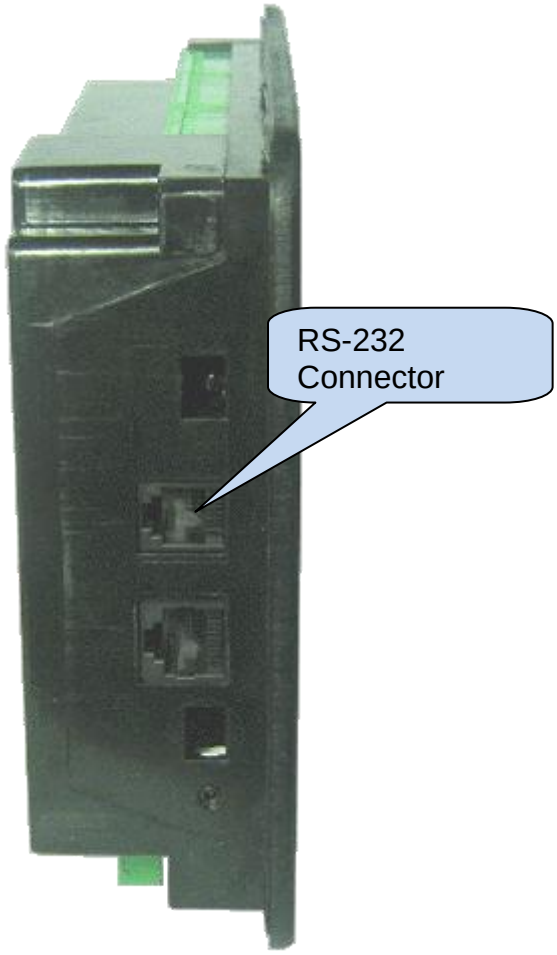
Digital outputs can be extended using **DKG-186 Fet Extension** modules, each one providing 8 outputs. Digital outputs have the same electrical characteristics as on board outputs. They have programmable functions through the main controller. Any function can be assigned to any output.

Input and output extension modules are connected to the main controller in a cascade structure, in any order. The connection cable is provided with each extension module.



3.10. RS-232 PORT

Description:	RS-232, non isolated.	
Functionality:	External modem, PC connection, PLC connection	
Connector:	RJ11-6pin	
Connection:	6 wires (Rx-Tx-DTR-CxD-GND-+10V). Full duplex.	
Baud rate:	9600 bauds	
Data type:	8 bit data, no parity, 1 bit stop	
Max distance:	15m	
Terminal description:	1: DTR output 2: Tx output 3: CxD input 4: GND 5: Rx input 6: +10V	 Front view of RJ11 6 pin connector



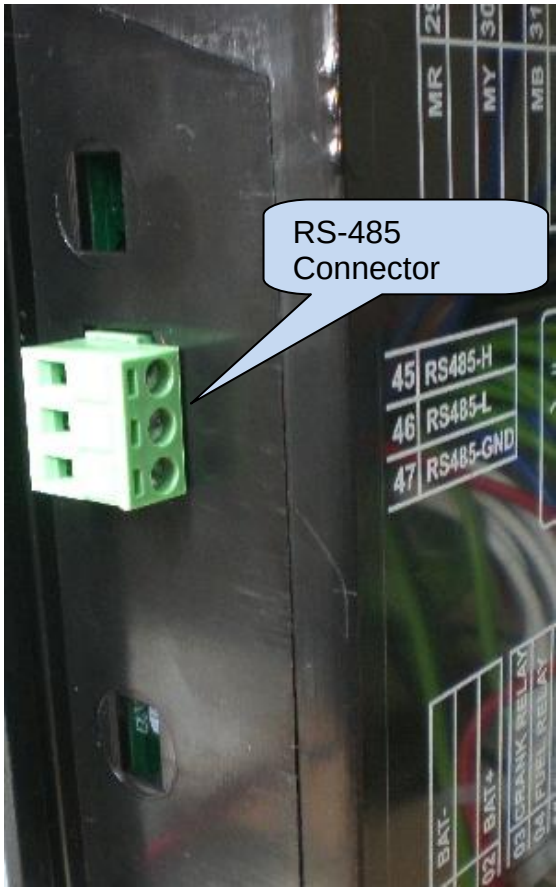
3.11. RS-485 PORT

Structure:	RS-485, non isolated.
Connection:	3 wires (A-B-GND). Half duplex.
Baud rate:	9600 bauds, selectable
Data type:	8 bit data, no parity, 1 bit stop
Termination:	External 120 ohms required
Common mode voltage:	-0.5 VDC to +7VDC, internally clamped by transient suppressors.
Max distance:	1200m @ 9600 bauds (with 120 ohms balanced cable)

The RS-485 port features MODBUS-RTU protocol. Multiple modules (up to 128) can be paralleled on the same RS-485 bus for data transfer to automation or building management systems.

The Modbus register list is available at Datakom technical support.

The RS-485 port provides also a good solution for distant PC connection where Rainbow program will enable programming, control and monitoring.



The RS-485 port is not isolated.

The external MODBUS device communicating with the unit should use the same potential as ground reference.

4. FUNCTIONALITIES

The same unit provides different functionalities through parameter setting. Thus a single stock item will fulfill various duties, minimizing stock cost.

4.1. CT LOCATION SELECTION

CTs may be placed at alternator or load busbars. The CT location selection is configured with **Controller Configuration > CT Location** parameter.

When CTs are located at the alternator side, them mains current and power parameters will not be displayed.

When CTs are located at load side, then both mains and genset currents and power parameters will be displayed, based on contactor positions.

Please review AMF functionality connection diagrams for CT connection details.

4.2. AMF FUNCTIONALITY

When AMF functionality is selected, the unit will monitor mains voltages, provide mains and genset contactor control, run the engine and provide engine and alternator instrumentation and fault monitoring.

4.3. REMOTE START FUNCTIONALITY

When the Remote Start functionality is selected, the unit will wait for a Remote Start signal from external controller. Upon reception of this signal, it will run the engine, and provide engine and alternator instrumentation and fault monitoring. The genset contactor control functionality will be available.

The unit features both MPU and J1939 CANBUS inputs. Thus both mechanical and electronic engines are supported.

4.4 REMOTE DISPLAY UNIT FUNCTIONALITY

The standard KG-545 unit may be configured as a remote display and control panel of another KG-545 unit.

The remote panel will have identical display and led status with the main unit and will allow the user to control the main unit with pushbuttons on the remote panel

The remote display/control panel needs to have the same RS-485 parameter settings with the main unit.

On the remote display/control panel, one of the digital inputs must be configured as “Annunciator Mode Enable”.

The remote panel will be connected to main unit through RS-485 lines and a modbus communication is established when “Annunciator Mode Enable” signal is applied to the display panel.

The data rate between the remote panel and the main unit is 9600 bps and this allows up to 1200m distance between 2 units. For the best results, a balanced, low capacitance, 120 ohms coaxial cable should be used for the RS-485 connection

Necessary program parameter setting is listed below:

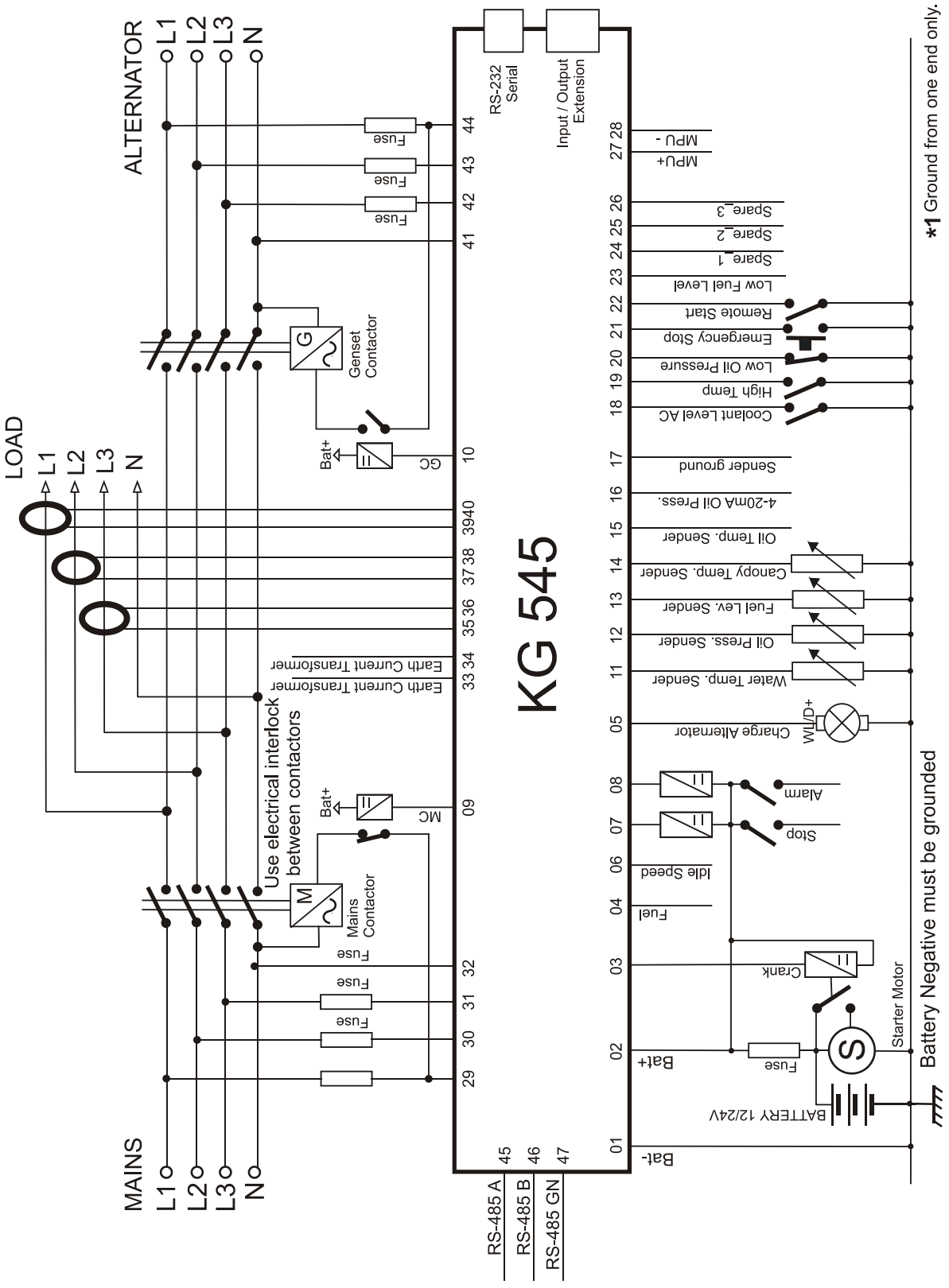
PARAMETER	MAIN UNIT	REMOTE DISPLAY UNIT
RS-485 Enable	1	1
Modbus Address	1	1 (same as main unit)
Digital Input-8 Function	any	Annunciator Mode Enable
Digital Input-8 Signal	x	0: Run Normally, 1: Run In Remote Panel

The remote display panel should be powered up with an isolated voltage source, like a wall adapter.

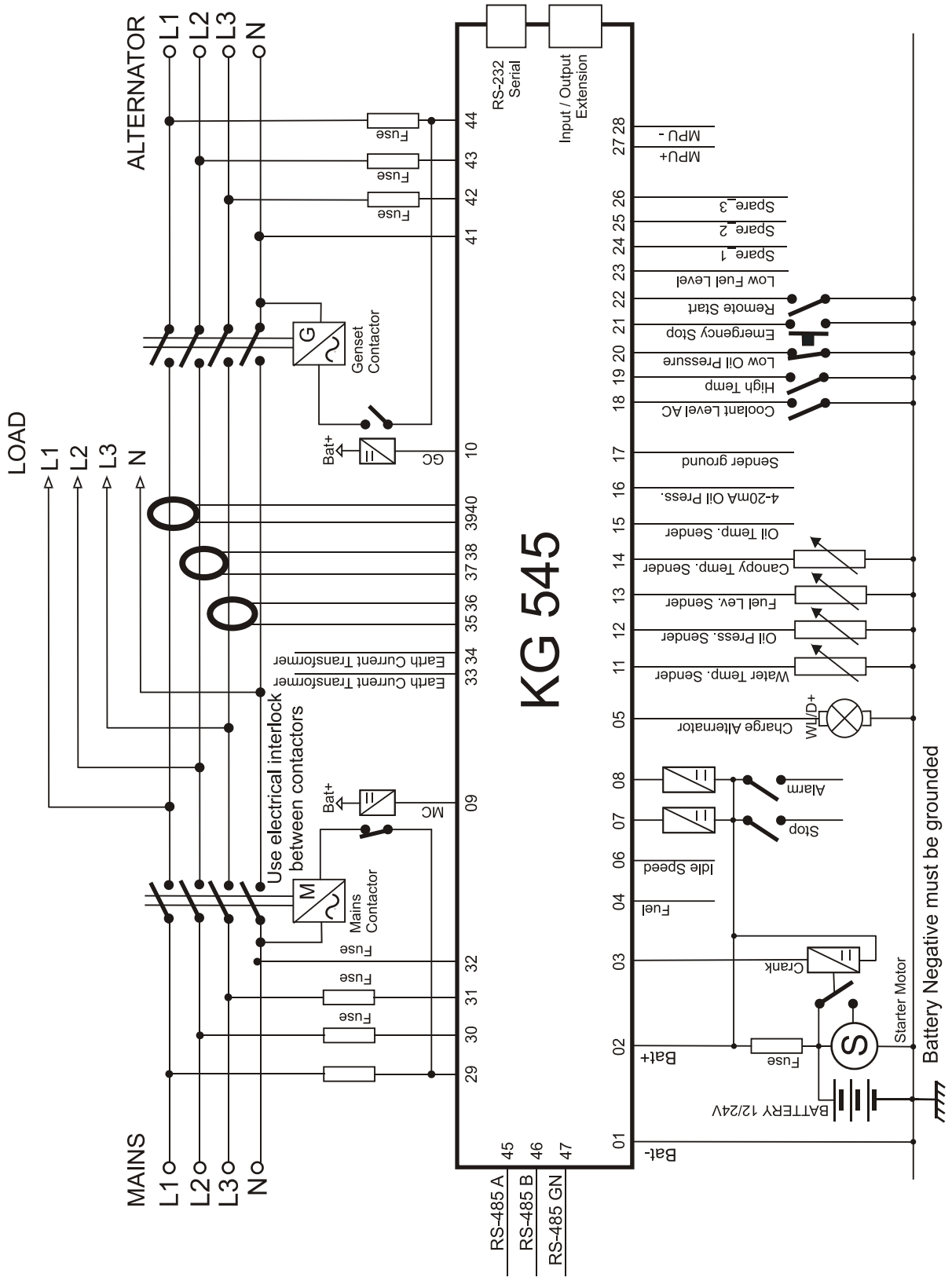
Otherwise damages due to ground potential differences may occur.

5. CONNECTION DIAGRAMS

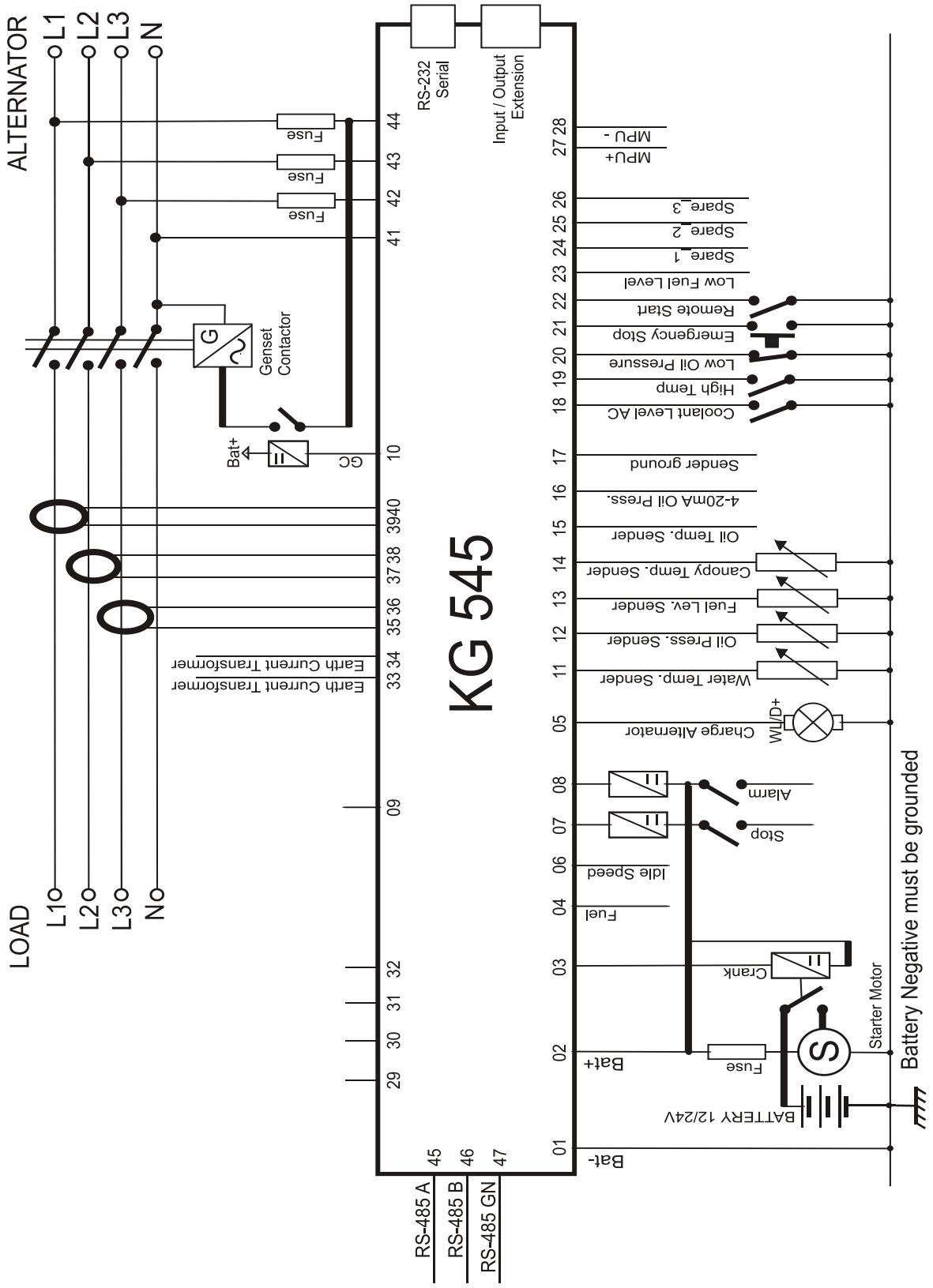
5.1. AMF FUNCTIONALITY, CTs AT LOAD SIDE



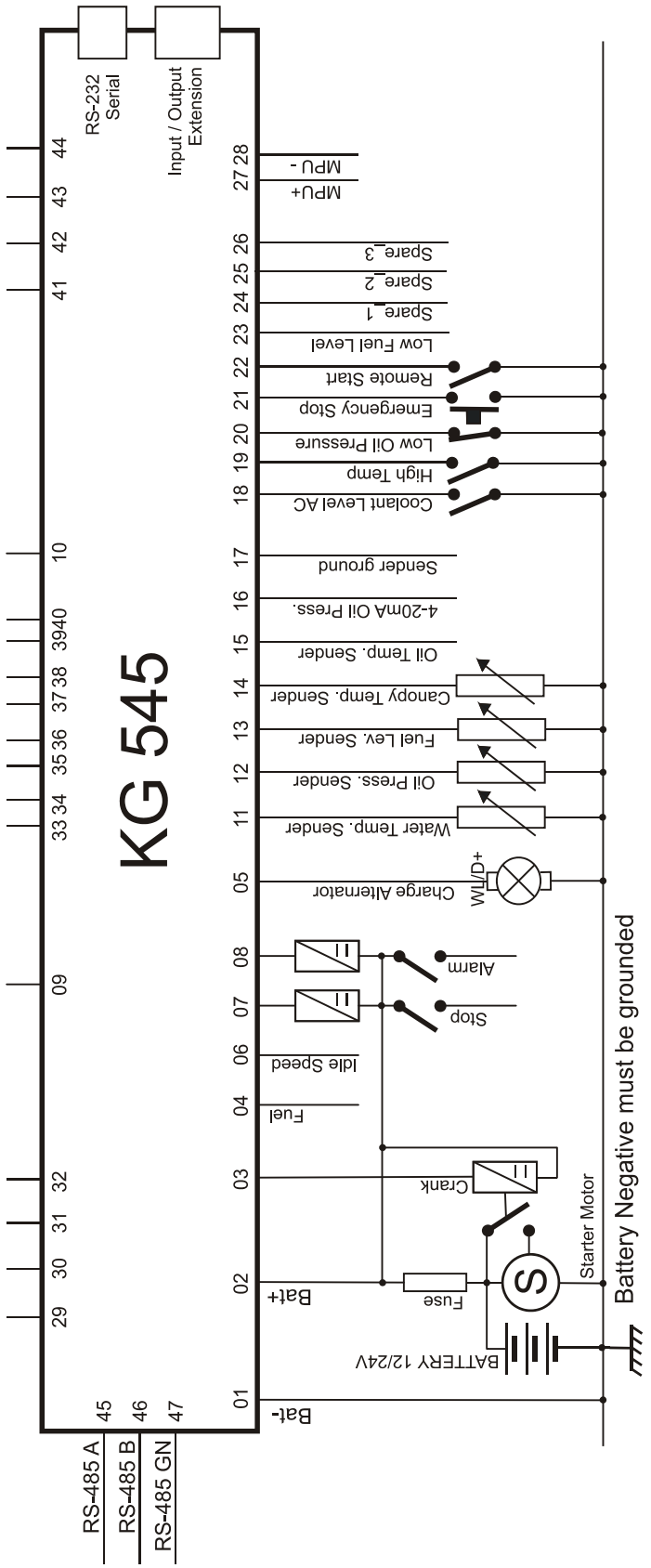
5.2. AMF FUNCTIONALITY, CTs AT ALTERNATOR SIDE



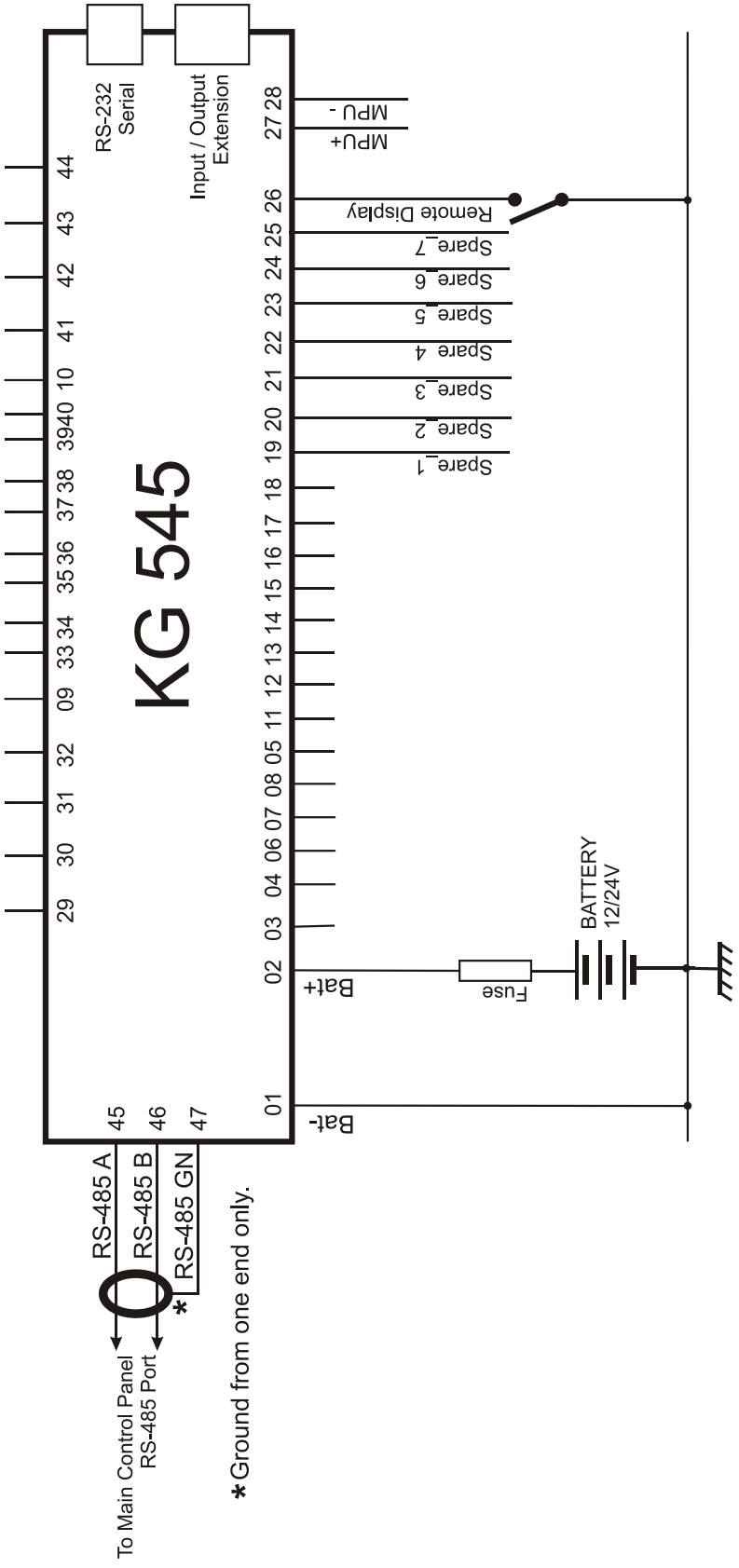
5.3. REMOTE START FUNCTIONALITY



5.4. ENGINE CONTROL FUNCTIONALITY



5.5. REMOTE DISPLAY PANEL FUNCTIONALITY



6. TERMINAL DESCRIPTION

Term	Function	Technical data	Description
01	**BATTERY NEGATIVE**	0VDC	Power supply negative connection.
02	**BATTERY POSITIVE**	+12 or 24VDC	The positive DC Supply terminal for both 12V and 24V battery systems.

Term	Function	Technical data	Description
03	**RELAY-01: CRANK OUTPUT**	Output 1A/28VDC	This output controls the engine cranking.
04	**RELAY-02: FUEL OUTPUT**	Output 1A/28VDC	Fuel solenoid output.
05	**CHARGER WL**	Input and output	Connect the charge alternator's D+ terminal to this terminal. This terminal will supply the excitation current and measure the voltage of the charge alternator.
06	**RELAY-03: IDLE OUTPUT**	Output 1A/28VDC	This output controls the idle speed operation.
07	**RELAY-04: STOP OUTPUT**	Output 1A/28VDC	This output controls the engine stop solenoid.
08	**RELAY-05: ALARM OUTPUT**	Output 1A/28VDC	This output controls the audible alarm (hooter)

Term	Function	Technical data	Description
09	**RELAY-06: MAINS CONTACTOR**	Output 1A/28VDC	This output controls the mains contactor. If the mains phase voltages and frequency are not within limits, the mains contactor will be de-energized.
10	**RELAY-07: GENSET CONTACTOR**	Output 1A/28VDC	This output controls the mains contactor. If the mains phase voltages and frequency are not within limits, the mains contactor will be de-energized.
11	**COOLANT TEMP. SENDER**	Input, 0-5000 ohms	Analogue temperature sender connection. Do not connect the sender to other devices. The input has programmable characteristics.
12	**OIL PRESSURE SENDER**	Input, 0-5000 ohms	Analogue oil pressure sender connection. Do not connect the sender to other devices. The input has programmable characteristics.
13	**FUEL LEVEL SENDER**	Input, 0-5000 ohms	Analogue fuel level sender connection. Do not connect the sender to other devices. The input has programmable ohm value.
14	**CANOPY TEMPERATURE SENDER**	Input, 0-5000 ohms	Analogue canopy temperature sender connection. Do not connect the sender to other devices.
15	**OIL TEMPERATURE SENDER**	Input, 0-5000 ohms	Analogue oil temperature sender connection. Do not connect the sender to other devices. The input has programmable characteristics.
16	**4-20mA OIL PRESSURE SENDER**	Input, 4-20mA	This input offers to the user an alternative oil pressure measurement capability and must be programmed before using.(Refer to Chapter 8 for more detail)
17	**SENDER GROUND / SPARE ANALOG INPUT -2**	Input +/-3VDC or Input, 0-5000 ohms	Used as sender ground.

Term	Function	Technical data	Description
18	COOLANT LEVEL	Digital input	This terminal drives the coolant level sensor with AC signal and senses the coolant liquid level.
19	IN-1: HIGH TEMP	Digital inputs	These inputs have programmable characteristics selected via the program menu. Each input may be driven by a 'normally closed' or 'normally open' contact, switching either to battery+ or battery-. The effect of the switch is also selectable from a list. See PROGRAMMING section for more details.
20	IN-2: LOW OIL PRESSURE		
21	IN-3: EMERGENCY STOP		
22	IN-4: AUTO START		
23	IN-5: LOW FUEL LEVEL		
24	IN-6: SPARE-1		
25	IN-7: SPARE-2		
26	IN-8: Low Coolant Level Sw.		

Term	Function	Technical data	Description
27	MAGNETIC PICKUP +	Inputs, 1-30V 0-8KHz	Connect the magnetic pickup signal to these inputs.
28	MAGNETIC PICKUP -		

Term	Function	Technical data	Description
29	MAINS-L1	Mains phase inputs, 0-300V-AC	Connect the mains phases to these inputs. The mains voltages upper and lower limits are programmable.
30	MAINS-L2		
31	MAINS-L3		
32	MAINS NEUTRAL	Input, 0-300V-AC	Neutral terminal for the mains phases.

Term	Function	Technical data	Description
33	CURR_E (S2)	Current transformer inputs, 5A-AC	Connect the earth current transformer terminals to these inputs.
34	CURR_E (S1)		
35	CURR_3 (S1)	Current transformer inputs, 5A-AC	Connect the load current transformer terminals to these inputs. Do not connect the same current transformer to other instruments otherwise a unit fault will occur. Connect each terminal of the transformer to the unit's related terminal. Do not use common terminals. Do not use grounding. Correct polarity of connection is vital. If the measured power is negative, then change the polarity of each 3 current transformers. The rating of the transformers should be the same for each of the 3 phases. The secondary winding rating shall be 5 Amperes. (For ex. 200/5 Amps).
36	CURR_3 (S2)		
37	CURR_2 (S1)		
38	CURR_2 (S2)		
39	CURR_1 (S1)		
40	CURR_1 (S2)		

Term	Function	Technical data	Description
41	GENERATOR NEUTRAL	Input, 0-300V-AC	Neutral terminal for the generator phases.
42	GEN-L3	Generator phase inputs, 0-300V-AC	Connect the generator phases to these inputs. The generator phase voltages upper and lower limits are programmable.
43	GEN-L2		
44	GEN-L1		

Term	Function	Technical data	Description
45	RS-485-A	Input / output	This is A terminal of the RS-485 port.
46	RS-485-B	Input / output	This is B terminal of the RS-485 port.
47	RS-485-GND	Output	This terminal is internally connected to battery negative. Connect the shield of the RS-485 cable to this terminal, from one end only.

7. TECHNICAL SPECIFICATIONS

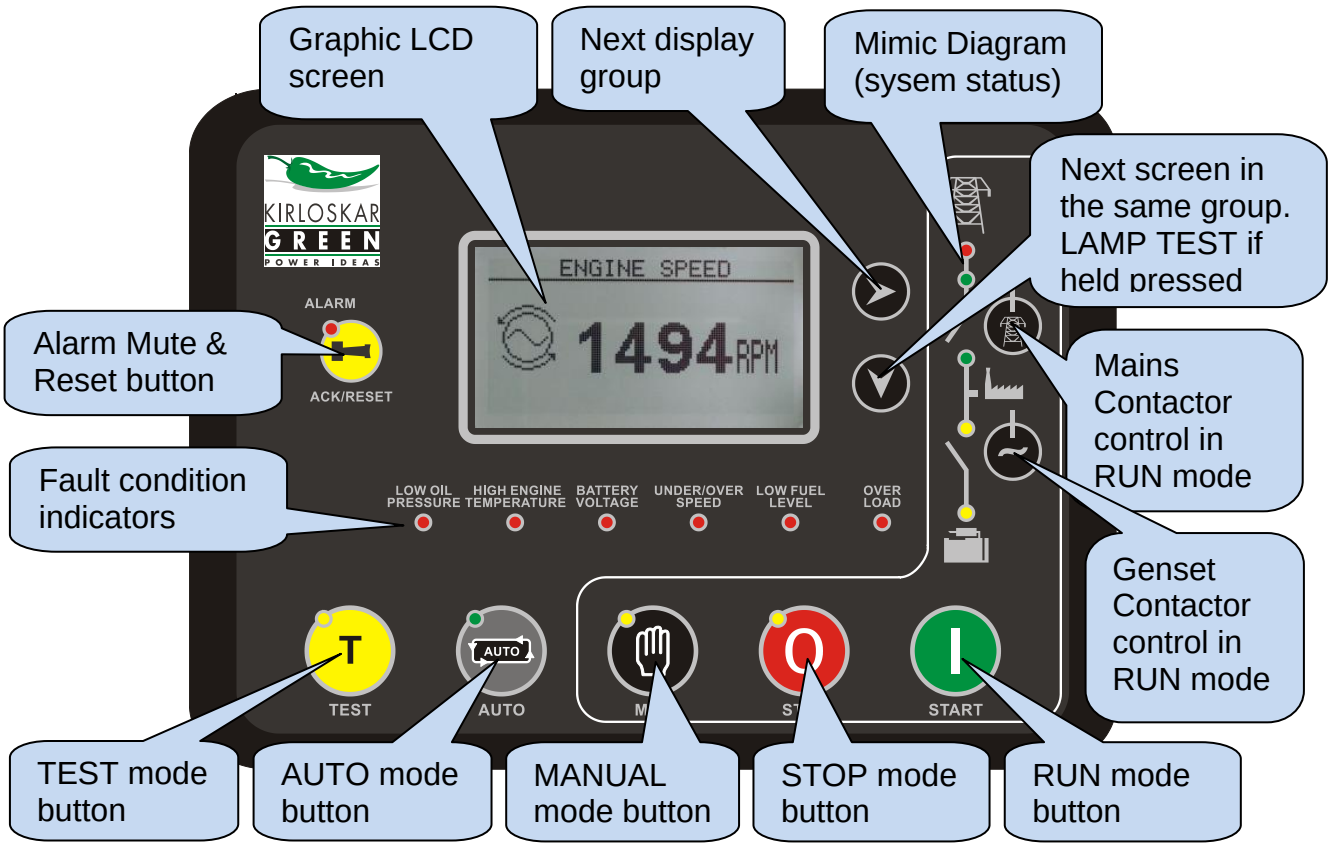
Alternator voltage: 0 to 300 V-AC Phase to Neutral (0 to 520 V-AC Phase to Phase)
Alternator frequency: 0-100 Hz.
Mains voltage: 0 to 300 V-AC Phase to Neutral (0 to 520 V-AC Phase to Phase)
Mains frequency: 0-100 Hz.
DC Supply range: 8.0 VDC to 36.0 VDC
Cranking dropouts: survives 0 V for 100ms
Typical stand-by current consumption: 130 mADC.
Maximum current consumption: 250 mADC.
Charge alternator excitation current: min 150 mADC @ 10 to 30 VDC.
Current inputs: from current transformers, .../5A. Max load 0.7VA per phase.
Accuracy:

Voltage:	0.5%+1digit
Current:	0.5%+1 digit
Frequency:	0.5%+1 digit
Power(kW,kVAr):	1.0%+2digit
Power factor:	0.5 %+1digit

Magnetic pickup input:: 0.5 – 30 Vac.
Magnetic pickup frequency: 8KHz max.
Digital inputs: input voltage 0 - 36 VDC. Internally connected to battery positive via 4700 ohm resistor.
Analog inputs: Resistor input 0 to 5000 ohms connected to the battery negative. Sources 5 mA when closed to battery negative.
Digital outputs: 1A @ 28 VDC. Protected semiconductor outputs.
Measurement category: CAT II
Air category: Pollution degree II
Communication port: RS-232/RS-485. 9600 bauds, no parity, 1 stop bit.
Operating temperature range: -20°C to +70°C (-4 ºF to +158 ºF)
Storage temperature range: -40°C to +80°C (-40 ºF to +176 ºF)
Maximum humidity: 95%, non-condensing
Dimensions: 202x148x48mm (WxHxD)
Panel Cut-out dimensions: 183 x 134mm minimum.
Weight: 400 g (approx.)
Case material: High temperature, self extinguishing ABS/PC (UL94-V0)
IP protection: IP65 from front panel, IP30 from the rear
Mounting: Flush mounted with rear retaining plastic brackets.
EU Directives Conformity
-2006/95/EC (low voltage)
-2004/108/EC (electro-magnetic compatibility)
Norms of reference:
EN 61010 (safety requirements)
EN 61326 (EMC requirements)
UL Compatibility: UL 508 - Industrial Control Equipment
CSA Compatibility: CAN/CSA C22.2 No. 14-2005 – Industrial Control Equipment

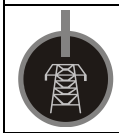
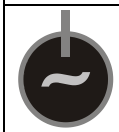
8. DESCRIPTION OF CONTROLS

8.1. FRONT PANEL FUNCTIONALITY



8.2. PUSHBUTTON FUNCTIONS

BUTTON	FUNCTION
	Selects TEST mode. The genset runs and takes the load.
	Selects AUTO mode. The genset runs when necessary and takes the load.
	Selects MANUAL mode. The genset operation is controlled manually with front panel pushbuttons.
	Active only when MANUAL mode is selected. The genset runs off-load.
	Selects STOP mode. The genset stops.

BUTTON	FUNCTION
	Selects next display group.
	Selects next display screen in the same display group.
	Resets existing ALARMS. Performs LAMP TEST when held pressed during 5 sec.
	Manual MAINS CONTACTOR control in MANUAL mode.
	Manual GENSET CONTACTOR control in MANUAL mode.
	When held pressed for 10 seconds, enters PROGRAMMING mode.

8.3. DISPLAY SCREEN ORGANIZATION

The unit measures a large number of electrical and engine parameters. The display of the parameters is organized as PARAMETER GROUPS and items in a group.

Navigation between different groups are made with button.

Each depression of the button will cause the display to switch to the next group of parameters. After the last group the display will switch to the first group.

Navigation inside a groups is made with button.

Each depression of the button will cause the display to switch to the next parameter in the same group. After the last parameter the display will switch to the first parameter.

Below is a basic list of parameter groups:

Genset Parameters: Genset voltages, currents, frequency, kW, kVA, kVAr, pf, kWh, etc...

Engine Parameters: Analog sender readings, rpm, battery voltage, engine hours, etc...

Mains Parameters: Mains voltages, currents, frequency. Mains currents are displayed only when CT Selection is made as LOAD SIDE. Otherwise mains currents will not be displayed.

Alarm Display: This group displays all existing alarms, one screen per alarm. When there is no more alarm to display it will show “END OF ALARM LIST”.

Status & Counters Groups: This group includes various parameters like genset status, company logo, service counters, date-time, site id, engine serial number, firmware version.

During operation, the unit will automatically switch between different screens, displaying always the most important parameters for the current operating status.

Group	Screen	Contents	Description
GENSET PARAMETERS	**1**	Genset Phase voltages, phase-to-neutral and phase-to-phase	Presented as a table.
	2	Genset Phase Currents and Genset frequency	Presented as a table.
	3	Genset Phase kW and power factor	Presented as a table.
	4	Genset Phase kVA and kVAr values	Presented as a table.
	5	Genset average current and voltage, genset frequency, total kW and PF	Presented as a table.
	6	Genset R Current	Genset Phase R Current, large characters
	7	Genset Y Current	Genset Phase Y Current, large characters
	8	Genset B Current	Genset Phase B Current, large characters
	9	Genset Frequency	with large size characters
	10	Genset Active Power	with large size characters
	11	Genset Average Voltage	with large size characters
	12	Genset kW-hours	8 digit counter
	13	Earth Leakage Current	in Amps and % of CT ratio, large characters

Group	Screen	Contents	Description
ENGINE PARAMETERS	**1**	Oil Pressure	Displayed in bars and kPa, large characters If PSİ display is enabled by program parameter, then displayed in bars and psi.
	2	Engine Temperature	Displayed in degrees C and degrees F, large characters
	3	Fuel Status	Displayed in % of full tank capacity. If **Fuel Consumption per Hour** parameter is not zero, then also displayed in engine hours. If **Fuel Tank Capacity** parameter is not zero, then also displayed in liters.
	4	Engine Speed	Displayed in RPMs
	5	Battery Voltage, Minimum battery voltage	Displayed in Volts DC. The Minimum Battery Voltage is reset before each engine crank cycle. Thus the displayed value reflects the most recent status.
	6	Oil Temperature	Displayed in degrees C and degrees F. This screen is displayed only if the Oil Temp analog input is enabled.
	7	Canopy Temperature	Displayed in degrees C and degrees F. This screen is displayed only if the Canopy Temp analog input is enabled.
	8	Engine Hours, Total Starts	The engine hours is displayed up to 999’999.9 hours. Total start count is displayed up to 9999.

Group	Screen	Contents	Description
MAINS PARAMETERS	**1**	Mains Phase voltages, phase-to-neutral and phase-to-phase	Presented as a table.
	2	Mains Phase Currents	Presented as a table. This screen is displayed only if CTs are selected at load side.
	3	Mains Frequency and Average Voltage	Frequency in Hertz. The voltage is the average of both phase voltages.

Group	Screen	Description
ALARM LIST	**1**	If no alarm exists, then **END OF ALARM LIST** is displayed. Otherwise the first alarm is displayed. Each depression of the button will cause the screen to switch to the next alarm.

Group	Screen	Description
COMMUNICATION STATUS	**1**	This screen shows the modem parameters. It is displayed only if the modem is enabled.

Group	Screen	Contents	Description
GENSET STATUS	**1**	Genset Status	Ascii explanation of the current status.
	2	Logo	The company logo, Kirloskar Green Power Ideas.
	3	Date & time	Current date and time, displayed in large characters.
	4	Site Id	The generator site id string, displayed in large characters.
	5	Serial Number	The generator serial number string, displayed in large characters.
	6	Software Version	The unit firmware version number displayed in large characters.
	7	Maintenance Counters	Time to maintenance (days) and engine hours to maintenance.

8.4. ALARM DISPLAY

If a fault condition occurs, the display will automatically switch to the ALARM LIST page.

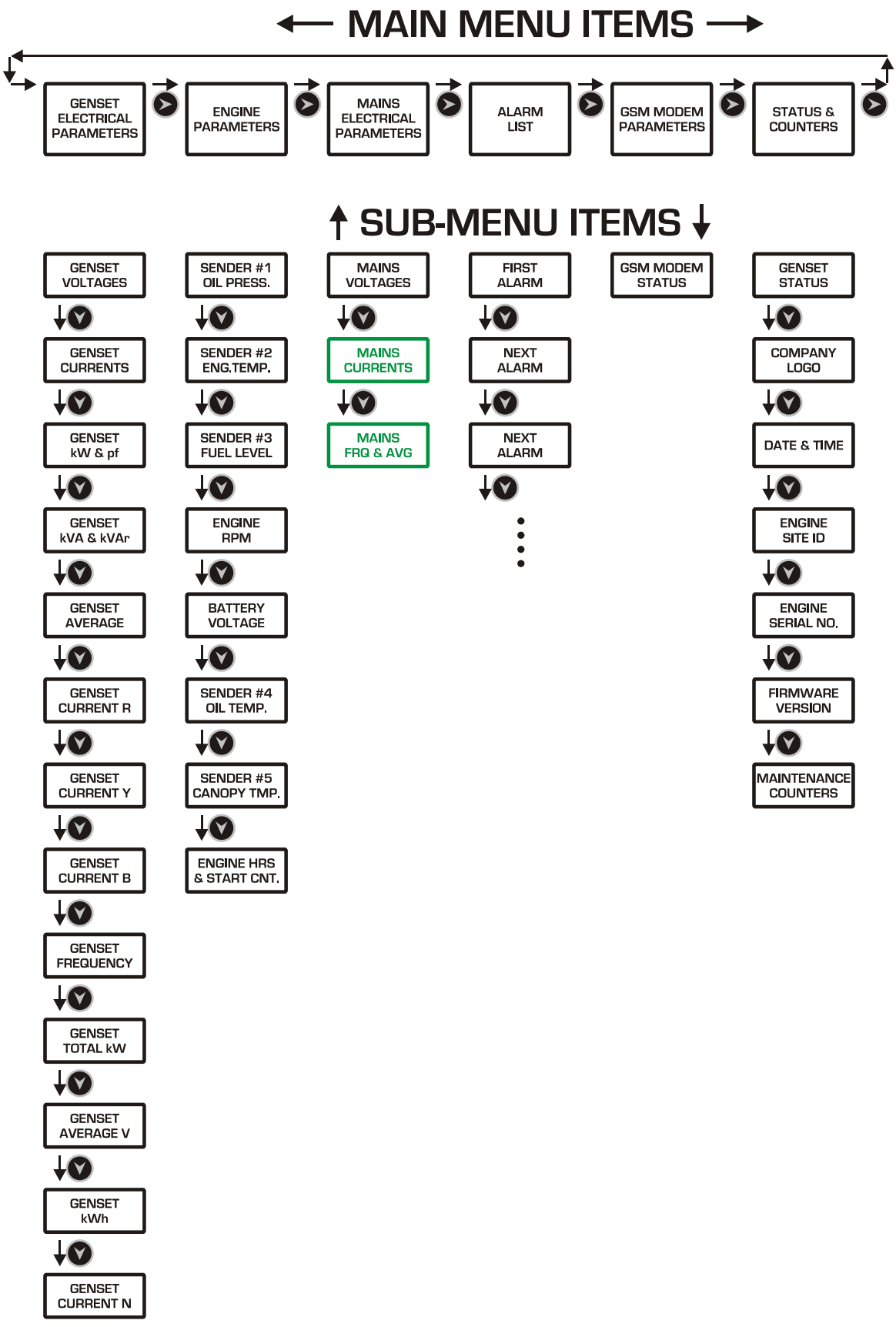
If an alarm or warning occurs during operation, in other then programming mode, the display will automatically switch to **ALARM LIST** position. The or buttons will not function. To enable display navigation and mute the internal buzzer, press **ACK/RESET** button first. If there is more than one alarm, the next alarm is displayed by pressing the button. Thus all existing alarms can be scanned. '**END OF ALARM LIST**' will be displayed when there is no more alarm to display.

8.5. AUTOMATIC DISPLAY SCROLL

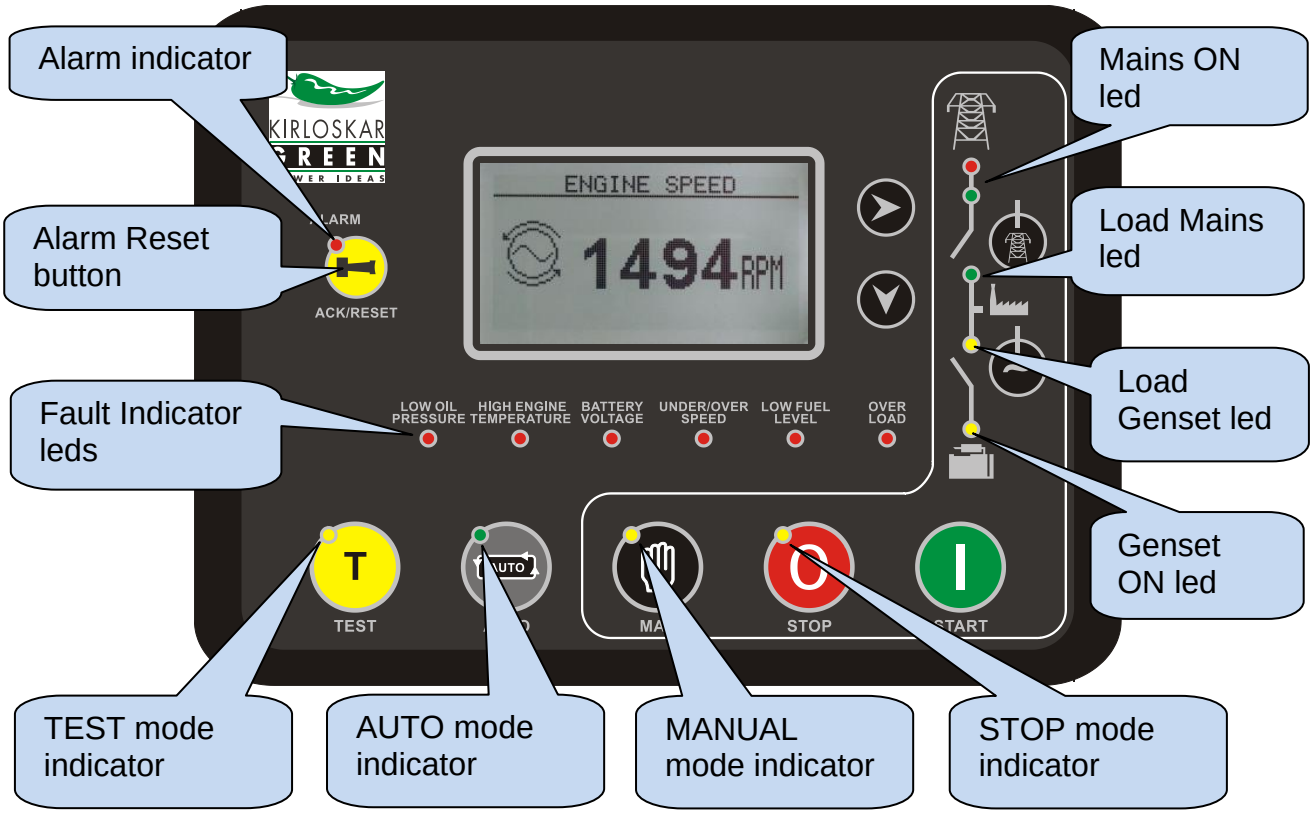
The unit will automatically scroll all Mains, Genset and Engine measurements with 4 seconds interval.

When a front panel button is pressed, the scrolling is suspended during 2 minutes.

8.6. DISPLAY NAVIGATION MAP



8.7. LED LAMPS



Function	Color	Description
MAINS ON	Green	This led turns on when all mains phase voltages and the mains frequency are within limits. If enabled, the mains phase rotation order must be also right. When a Remote Start signal is present, then the mains status will become “not available”.
MAINS OFF	Red	The LED will turn on when at least one of the mains phase voltages or the mains frequency or phase order is outside limits.
LOAD MAINS	Green	It turns on when the mains contactor is activated.
LOAD GENERATOR	Yellow	It turns on when the generator contactor is activated.
GENERATOR	Yellow	The LED will flash when the engine is running. It will turn on steadily when all 3 generator phase voltages and the genset frequency are within limits. If enabled, the genset phase rotation order must be also right.
TEST	Yellow	It turns on when the related operation mode is selected. One of these LEDs is always on and indicates which operation mode is selected. If the operation of the genset is disabled by the **weekly operation schedule**, then the **AUTO** led will flash.
STOP	Yellow	
AUTO	Green	
MANUAL	Yellow	

Function	Color	Description
ALARM	Red	If a fault condition resulting to the engine shutdown has occurred, the alarm led turns on steadily. If a warning condition occurs, this led will flash. Alarms work on a first occurring basis. The occurrence of a fault will disable other faults of lower or equal priority.
LOW OIL PRESSURE	Red	Turns on when a low oil pressure condition is detected either from the sender or switch input.
HIGH ENGINE TEMP	Red	Turns on when a high coolant temperature condition is detected either from the sender or switch input.
BATTERY VOLTAGE	Red	Turns on when a low or high battery voltage condition is detected.
UNDER/OVER SPEED	Red	Turns on when a low or high speed condition is detected.
LOW FUEL LEVEL	Red	Turns on when a low fuel level condition is detected either from the sender or switch input.
OVERCURRENT	Red	Turns on when overcurrent condition is detected.
EXCESS POWER	Red	Turns on when excess load condition is detected.

If a Remote Start signal is present, then the Mains led will become red.

Simulate Mains and Force to Start signals will also affect this led.

If the operation of the genset is disabled by the weekly operation schedule, then the AUTO led will flash.

8.8. MEASURED PARAMETERS

The unit performs a detailed set of measurements. The list of measured parameters is below:

Mains voltage phase L1 to neutral
Mains voltage phase L2 to neutral
Mains voltage phase L3 to neutral
Mains voltage phase L1-L2
Mains voltage phase L2-L3
Mains voltage phase L3-L1
Mains current phase L1
Mains current phase L2
Mains current phase L3
Mains frequency
Gen voltage phase L1 to neutral
Gen voltage phase L2 to neutral
Gen voltage phase L3 to neutral
Gen average voltage phase to neutral
Gen voltage phase L1-L2
Gen voltage phase L2-L3
Gen voltage phase L3-L1
Gen current phase L1
Gen current phase L2
Gen current phase L3
Gen average current
Gen frequency
Gen kW phase L1
Gen kW phase L2
Gen kW phase L3
Gen total kW
Gen kVA phase L1
Gen kVA phase L2
Gen kVA phase L3
Gen kVAr phase L1
Gen kVAr phase L2
Gen kVAr phase L3
Gen pf phase L1
Gen pf phase L2
Gen pf phase L3
Gen total pf
Earth leakage current
Engine speed (rpm)
Battery voltage,
Coolant temperature
Oil pressure (bar, kPa)
Fuel level (%, lt)
Oil temperature (°C, °F)
Canopy temperature (°C, °F)

9. DISPLAYING EVENT LOGS

The unit keeps record of the last **100** events in order to supply information for the service personal.

The date-time, genset status information and a comprehensive set of measured values are stored within the event memory. The events are recorded with a time stamp which comes from the internal real time clock circuit of the unit. Events are kept in a non-volatile memory and are not affected from power failures.

The events are stored in a circular memory. This means that a new coming event will erase the oldest recorded event. The events are always displayed starting from the most recent one.

Stored values in an event record are listed below:

-event number
-event type / fault definition (see below for various event sources)
-date and time
-engine hours run
-operation mode (AUTO, MANUAL,OFF,TEST)
-operation status (on-load, on-mains, cranking, etc...)
-mains phase voltages: R-Y-B
-mains frequency
-genset phase voltages: R-Y-B
-genset phase currents: R-Y-B
-genset frequency
-genset total active power (kW)
-genset total power factor
-oil pressure
-engine temperature
-fuel level
-oil temperature
-canopy temperature
-ambient temperature
-engine rpm
-battery voltage
-charge voltage

Possible event sources are various:

Periodic event: recorded every 60 minutes when the engine is running, and every 120 minutes anyway.

Engine crank event: recorded when the crank output is engaged.

Shutdown alarm event: recorded when a shutdown alarm occurs.

Loaddump alarm event: recorded when a loaddump alarm occurs.

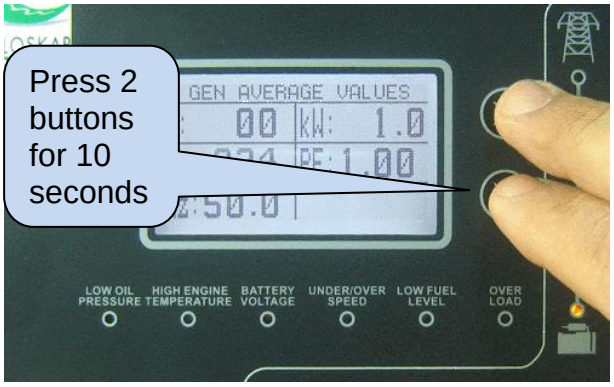
Warning event: recorded when a warning occurs.

Program mode entrance event: recorded when program mode is entered. The password level is also saved.

Event logs are displayed within the program mode menu. This is designed in order to reduce the interference of event logs with other measurement screens.

To **enter the event display**, press together and buttons for 10 seconds.

When the program mode is entered, below password entry screen will be displayed.



Skip the password entry screen by pressing the button 4 times. The screen below left will come.

Press again the button. The last stored event will open, as in the below-right picture.

The first page will display the event number, event type, fault type and date-time information.

When displaying event logs:

button will display the same information of the previous event

button will display the next information in the same event. When the last page is reached, it will return to the first page.

To exit event record pages press (STOP) button.

10. OPERATION OF THE UNIT

10.1. QUICK START GUIDE

STOPPING THE ENGINE: Press STOP button; the engine will enter cooldown mode. Press again STOP button for immediate stop.

STARTING THE ENGINE: Press MANUAL then press RUN button

MANUAL LOAD TRANSFER: Use MAINS and GENSET buttons.

LOAD TEST: Press TEST button. The genset will run and take the load.

AUTOMATIC OPERATION: Press AUTO button.

Mode can be changed anytime without negative effect.
Changing the operation mode while the genset is running will result into a behavior suitable for the new operating mode.

10.2. STOP MODE

The STOP mode is entered by pressing the button.

In this mode, the genset will be in a rest state.

When STOP mode is selected, if the genset is running under load, then it will be immediately unloaded. The engine will continue to run during **Cooldown Timer** and will stop afterwards.

If the STOP button is pressed again, then the engine will immediately stop.

If the engine fails to stop after the expiration of **Stop Timer** then a **Fail to Stop** warning will occur.

In this mode, the mains contactor will be energized only if mains phase voltages and frequency are within the programmed limits. If enabled, the mains phase order is also checked.

If a **Remote Start** or **Force to Start** signal arrives in STOP mode, the genset will not start until **AUTO** mode is selected.

10.3. AUTO MODE

The AUTO mode is entered by pressing the button.

The AUTO mode is used for the automatic transfer between genset and mains. The controller will constantly monitor the mains availability. It will run the engine and transfer the load when a mains failure occurs.

If a panel lock input is defined and signal is applied, then mode change will not occur. However display navigation buttons are still enabled and parameters may be visualized.

The mains availability evaluation sequence is below:

- If at least one of the mains phase voltages or the mains frequency is outside limits, the mains will be supposed failing. Otherwise mains is available.
- If a Simulate Mains signal is present, then mains are made available
- If a Remote Start signal is present, then mains are unavailable

When mains are evaluated as "unavailable" then an engine start sequence begins:

- The unit waits during Engine Start Delay for skipping short mains failures. If the mains is restored before the end of this timer, the genset will not start.
- The unit turns on the fuel and preheat glow plugs (if any) and waits for preheat timer.
- The engine will be cranked for programmed times during crank timer. When the engine fires, the crank relay will be immediately deactivated. See section **Crank Cutting** for more details.
- The engine will run at idle speed during Idle Speed Timer.
- The engine will run unloaded during engine heating timer.
- If alternator phase voltages, frequency and phase order are correct, the unit will wait for the generator contactor period and the generator contactor will be energized.

When mains are evaluated as "available" again then an engine stop sequence begins:

- The engine will continue to run for the mains waiting period to allow mains voltages to stabilize.
- Then the generator contactor is deactivated and the mains contactor will be energized after mains contactor timer.
- If a cooldown period is given, the generator will continue to run during the cooldown period.
- Before the end of cooldown, the unit will reduce the engine speed to idle speed.
- At the end of cooldown, the fuel solenoid will be de-energized, the stop solenoid will be energized for Stop Solenoid timer and the diesel will stop.
- The unit will be ready for the next mains failure.

If the operation of the genset is disabled by the weekly schedule, then the AUTO led will flash, and the operation of the genset will be as in the OFF mode.

10.4. MANUAL MODE

The MANUAL mode is entered by pressing the button.

When the RUN button is pressed, the engine will be started regardless of the mains availability.

The starting sequence is as described below:

- The unit turns on the fuel and preheat glow plugs (if any) and waits for preheat timer.
- The engine will be cranked for programmed times during crank timer. When the engine fires, the crank relay will be immediately deactivated. See section **Crank Cutting** for more details.
- The engine will run at idle speed during Idle Speed Timer.
- The engine will run unloaded until another mode is selected..

The MANUAL mode allows also manual contactor control through MC and GC buttons.

When a contactor button is pressed, the related contactor will change position. Thus if it was on, then it will turn off. If it was off then it will turn on.

If the other contactor was on, then it will turn off, the controller will wait for the related contactor timer and the contactor will turn on. This will prevent manual closure of both contactors.

If Emergency Backup mode is enabled and if the mains are off, then the mains contactor will be deactivated and the generator contactor will be activated.

When the mains are on again, a reverse changeover to the mains will be performed, but the engine will be kept running unless another mode is selected.

In order to stop the engine press button or select another mode of operation.

10.5. TEST MODE

The TEST mode is entered by pressing the button.

The TEST mode is used in order to test the genset under load.

Once this mode is selected, the engine will run as described in the AUTO mode, regardless of the mains availability and the load will be transferred to the genset.

The genset will feed the load indefinitely unless another mode is selected.

11. PROTECTIONS AND ALARMS

The unit provides 3 different protection levels, being warnings, loaddumps and shutdown alarms.

1- **SHUTDOWN ALARMS:** These are the most important fault conditions and cause:
   - The **ALARM** led to be on steadily,
   - The genset contactor to be released immediately,
   - The engine to be stopped immediately,
   - The **Horn**, **Alarm**, **Alarm+Load_dump** and **Alarm+Load_dump+Warning** digital outputs to operate, (if selected via programming menu)

2- **LOAD_DUMPS:** These fault conditions cause:
   - The ALARM led to be on steadily,
   - The genset contactor to be released immediately,
   - The engine to be stopped after Cooldown period,
   - The **Horn**, **Alarm+Load_dump** and **Alarm+Load_dump+Warning** digital outputs to operate, (if selected via programming menu)

3- **WARNINGS:** These conditions cause:
   - The ALARM led to flash,
   - The **Horn** and **Alarm+Load_dump+Warning** digital outputs to operate, (if selected via programming menu)

If a fault condition occurs, the display will automatically switch to the ALARM LIST page.

Alarms operate in a first occurring basis:

-If a shutdown alarm is present, following shutdown alarms, loaddumps and warnings will not be accepted,

-If a loaddump is present, following loaddumps and warnings will not be accepted,

-If a warning is present, following warnings will not be accepted.

If the ACK/RESET button is pressed, the Alarm output will be deactivated; however the existing alarms will persist and disable the operation of the genset.
A second press on ACK/RESET button will clear existing alarms.

Alarms may be of **LATCHING** type following programming.

For latching alarms, even if the alarm condition is removed, the alarms will stay on and disable the operation of the genset.

Existing alarms may be canceled by pressing one of the operating mode buttons:

Most of the alarms have programmable trip levels. See the programming chapter for adjustable alarm limits.

11.1. SERVICE REQUEST WARNING

The SERVICE REQUEST led is designed to help the periodic maintenance of the genset to be made consistently.

The periodic maintenance is basically carried out after a given engine hours (for example 200 hours), but even if this amount of engine hours is not fulfilled, it is performed after a given time limit (for example 12 months).

The SERVICE REQUEST warning has no effect on the genset operation.

The unit has both programmable engine hours and maintenance time limit. The engine hours is programmable with 50-hour steps, the time limit is programmable with 1 month steps. If any of the programmed values is zero, this means that the parameter will not be used. For example a maintenance period of 0 months indicates that the unit will request maintenance only based on engine hours, there will be no time limit. If the engine hours is also selected as 0 hours this will mean that the SERVICE REQUEST display will be inoperative.

When the engine hours **OR** the time limit is over, the **SERVICE REQUEST** warning will occur.

The service request output function may be assigned to any digital output using **Relay Definition** program parameters. Also relays on an extension module may be assigned to this function.

To turn off the SERVICE REQUEST led, and reset the service period, press together the ACK/RESET and keys for 5 seconds.

The remaining engine hours and the remaining time limits are kept stored in a non-volatile memory and are not affected from power supply failures.

The time and engine hours to service are displayed in the **STATUS & COUNTERS** menu group.

11.2. ALARMS AND WARNINGS

Digital input alarms are fully programmable for the alarm name, sampling and action.

Only internal alarms are explained in this section.

GENSET LOW / HIGH SPEED ALARM	Set if the generator frequency is outside programmed limits for **Genset Speed Fail Timer**. These faults will be monitored with **Holdoff Timer** delay after the engine is running. Low and high limits for warning and alarm are separately programmable. Another high frequency shutdown limit which is 6% above the high limit is always monitored and stops the engine immediately. If engine rpm limits are programmed, these faults will be equally set using engine rpm limits.
GENSET LOW / HIGH VOLTAGE ALARM	Set if any of the generator phase voltages goes outside programmed limits for **Genset Voltage Fail Timer**. This fault will be monitored with **Fault Holdoff Timer** delay after the engine is running.
LOW / HIGH BATTERY VOLTAGE WARNING, **HIGH BATTERY VOLTAGE ALARM**	Set if the genset battery voltage is outside programmed limits. Low and high limits are separately programmable. The low limit is not checked during engine cranking.
CHARGE FAIL WARNING/ALARM	Set if a charge alternator failure (or broken belt) occurs. This fault condition may result to a **warning** or **alarm** following programming.
LOW OIL PRESSURE WARNING/ALARM	Set if a signal is detected at the Low Oil Pressure Switch input or the oil pressure value measured from the sender is below the programmed limit. Warning and alarm limits are separately programmable for the oil pressure sender input. This fault will be monitored with **Holdoff Timer** delay after the engine is running. Also if the oil pressure switch is open at the beginning of a start attempt, then the engine will not be started and "**Oil Pressure Exists!**" information is displayed. When the oil pressure switch closes, normal operation will be resumed.
HIGH TEMPERATURE WARNING/ALARM	Set if a signal is detected at the High Temperature Switch input or the coolant temperature value measured from the sender is above the programmed limit. Warning and alarm limits are separately programmable for the temperature sender input.
LOW TEMPERATURE WARNING	Set if the coolant temperature value measured from the sender is below the **Engine Heating Temperature** limit.
LOW FUEL WARNING/ALARM	Set if a signal is detected at the low fuel level input or the the fuel level measured from the sender is below the programmed limit. Warning and alarm limits are separately programmable for the fuel level sender input.
HIGH OIL TEMPERATURE WARNING/ALARM	Set if the oil temperature value measured from the sender is above the programmed limit. Warning and alarm limits are separately programmable for the temperature sender input.
HIGH CANOPY TEMPERATURE WARNING/ALARM	Set if the canopy temperature value measured from the sender is above the programmed limit. Warning and alarm limits are separately programmable for the temperature sender input.
LOW COOLANT LEVEL AC ALARM	Set if the coolant level AC input is enabled, and coolant level AC input is open circuit.

OVERCURRENT LOADDUMP	Set if one of the genset phase currents goes over the **Overcurrent Limit** for **Overcurrent Timer**. If currents go below the limit before expiration of the timer then no alarm will be set.
EXCESS POWER LOADDUMP	Set if the genset power (kW) supplied to the load goes over the **Excess Power** limit for **Overload Timer**. If the power goes below the limit before expiration of the timer then no alarm will be set.
REVERSE POWER WARNING/LOADDUMP	Set if the genset power (KW) supplied to the load is negative and goes over the **Reverse Power** limit for **Overload Timer**. If the power goes below the limit before expiration of the timer then no alarm will be set.
HIGH EARTH CURRENT WARNING/LOADDUMP	Set if the earth current goes over the **Earth Current Warning or Loaddump Limit** for **Earth Fault Delay Timer**. If the current goes below the limit before expiration of the timer then no alarm will be set. Separate loaddump and warning limits are available through program menu.
GENSET PHASE ORDER FAIL LOADDUMP	Set if the genset phase order checking is enabled, genset phases are present and genset phase order is reversed.
MAINS PHASE ORDER FAIL WARNING	Set if the mains phase order checking is enabled, mains phases are present and mains phase order is reversed. This fault prevents the Mains Contactor to close.
FAIL TO START ALARM	Set if the engine is not running after programmed number of start attempts. In MANUAL mode only 1 start attempt is performed.
FAIL TO STOP	Set if the engine has not stopped before the expiration of the Stop Timer.
AUTO START LOCK OUT WARNING/LOADDUMP	The warning is set when a remote start signal arrives in MANUAL mode, when the engine is in rest position. If AUTO mode is selected when this warning is present, then a loaddump alarm will be given and the engine will not start.
OIL PRESSURE SENDER FAULT WARNING/LOADDUMP	Set if the fault is enabled and the sender is open circuit.
ENGINE TEMP SENDER FAULT WARNING/LOADDUMP	Set if the fault is enabled and the sender is open circuit.
FUEL LEVEL SENDER FAULT WARNING/LOADDUMP	Set if the fault is enabled and the sender is open circuit.
OIL TEMPERATURE SENDER FAULT WARNING/LOADDUMP	Set if the fault is enabled and the sender is open circuit.
CANOPY TEMPERATURE SENDER FAULT WARNING/LOADDUMP	Set if the fault is enabled and the sender is open circuit.
SERVICE REQUEST	Set if at least one of the service counters has expired.

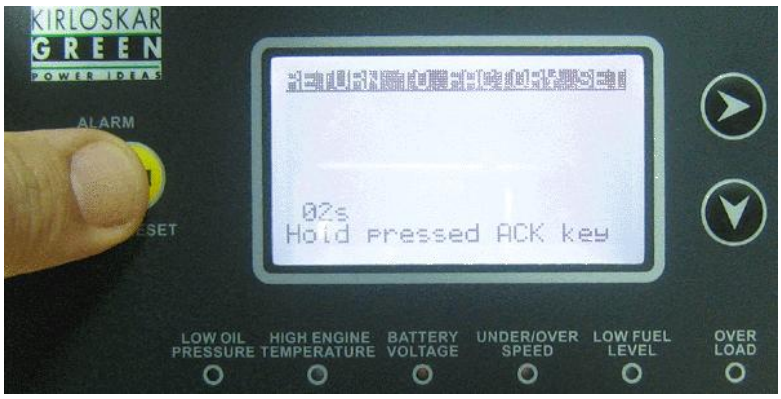
12. PROGRAMMING

12.1. RESETTING TO FACTORY DEFAULTS

In order to resume to the factory set parameter values:

-hold pressed the **OFF, ACK/RESET** and ➤ buttons for 5 seconds,
-"**RETURN TO FACTORY SET**" will be displayed
-immediately press and hold pressed the **ACK/RESET** button for 5 seconds
-factory set values will be reprogrammed to the parameter memory.

*Hold pressed **OFF, ACK/RESET** and* ➤



*Hold pressed **ACK/RESET***

The program mode is used to adjust timers, operational limits and the configuration of the unit.

Although a free PC program is provided for programming, every parameter may be modified through the front panel, regardless of the operating mode.

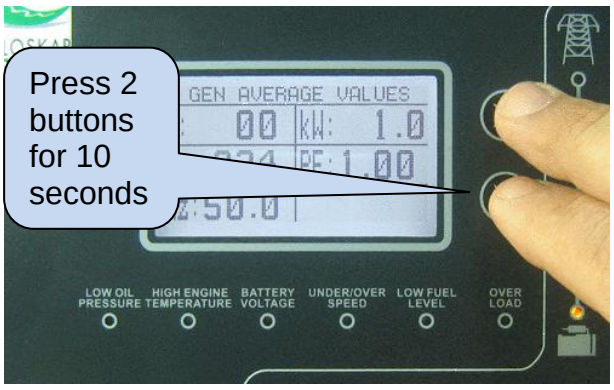
When modified, program parameters are automatically recorded into a non-erasable memory and take effect immediately.

The program mode will not affect the operation of the unit. Thus programs may be modified anytime, even while the genset is running.

12.2. ENTERING THE PROGRAMMING MODE

To **enter the program mode**, press together and buttons for 10 seconds.

When the program mode is entered, below password entry screen will be displayed.



A 4 digit password must be entered using **ACK/RESET,** and buttons.

The unit stores 2 different passwords. Each password allows access to a different level of program parameters.

The password level-1 allows access to field adjusted parameters. The level-2 allows access to factory setup.

The password level-1 is factory set to '**1234**' and the password level-2 is factory set to '**9876**'.

Passwords are not front panel adjustable.

The program mode will not affect the operation of the unit. Thus programs may be modified anytime, even while the genset is running.

If a wrong password is entered, the unit will still allow access to the program parameters, but in read-only mode.

If password "0000" is entered, only EVENT LOG file will be available.

12.3. NAVIGATING BETWEEN MENUS

The program mode is driven with a two level menu system. The top menu consists on program groups and each group consists on various program parameters.

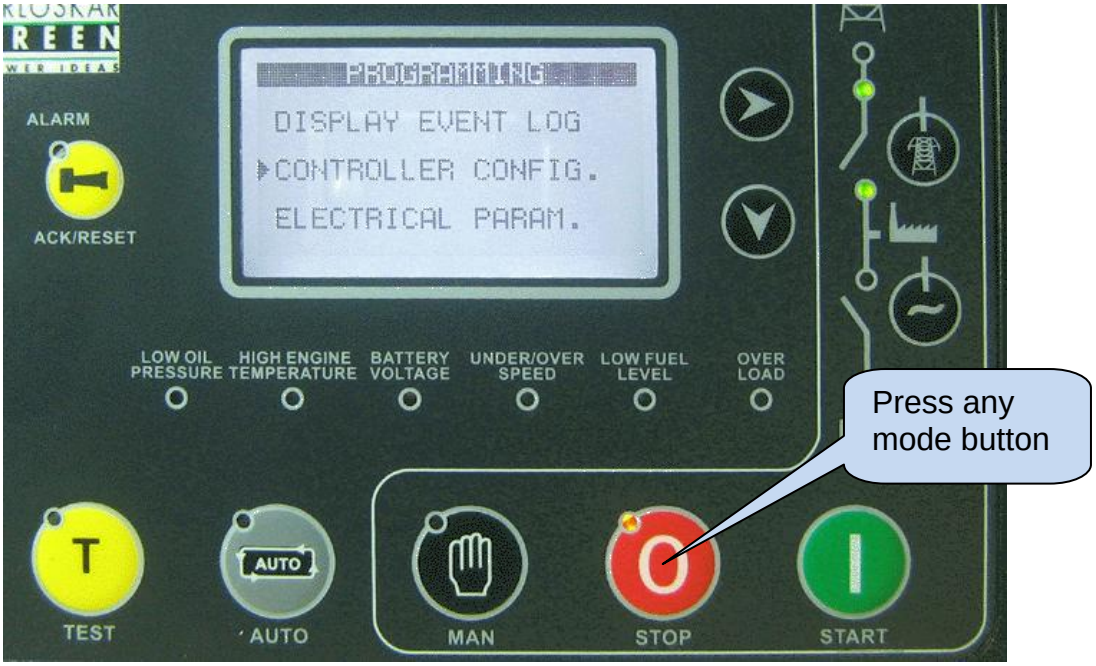
When program mode is entered, a list of available groups will be displayed. Navigation between different groups are made with and buttons. A "►" character will appear at the first column of the selected group. In order to enter inside a group, please press . In order to exit from the group to the main list please press **STOP** button.

Navigation inside a group is made also with and buttons. A list of available parameters will be displayed. A "►" character will appear at the first column of the selected parameter. In order to display/change the value of this parameter, press button. Parameter value may be increased and decreased with and buttons. If these buttons are hold pressed, the program value will be increased/decreased by steps of 10. When a program parameter is modified, it is automatically saved in memory. If button is pressed, next parameter will be displayed. If button is pressed, then the list of parameters in this group will be displayed.

12.4. MODIFYING PARAMETER VALUE

12.5. PROGRAMMING MODE EXIT

To **exit the program mode** press one of the mode selection keys. If no button is pressed during 1 minute the program mode will be cancelled automatically.



13. PROGRAM PARAMETER LIST

13.1. CONTROLLER CONFIGURATION GROUP

Parameter Definition	Unit	Factory Set	Description
LCD Contrast	-	35	This parameter is used to set LCD contrast. Adjust for the best viewing angle.
Language	-	0	**0:** English language selected. **1:** Turkish language selected. This language may depend on the country where the unit is intended to be used. **2:** Chinese language selected **3:** The unit will ask for manual language selection at power-on.
Genset Default Display	-	0	This parameter selects the screen which is displayed first during genset on load operation. **0:** genset voltage table **1:** genset currents table **2:** genset kW table **3:** genset average values table Details of each screen are explained in chapter 3.2
Fault Holdoff Timer	sec	12	This parameter defines the delay after the engine runs and before the fault monitoring is enabled.
Alarm Relay Timer	sec	60	This is the period during which the **ALARM** relay is active. If the period is set to 0, this will mean that the period is unlimited.
Intermittent Alarm Relay	-	0	**0:** continuous **1:** intermittent (turns on and off every second)
Charge Alternator Shutdown	-	0	**0:** The charge input generates **CHARGE FAIL** warning, and does not stop the engine. **1:** The charge input generates **CHARGE FAIL** alarm, and stops the engine.
Emergency Backup Operation	-	0	**0:** In TEST mode, the load will not be transferred to the genset even if the mains fail. **1:** In TEST mode, the load will be transferred to the genset if the mains fail.
Exercise Day and Time	-	168	This parameter defines the start day and hour of the exerciser. Values higher or equal to 168 mean that the exerciser is off. The exercise may be selected to start at the beginning of the any hour of the week. The parameter value is the hour count of the start time. Examples: 0 = exercise starts at Monday 00:00 8 = exercise starts at Monday 08:00 24 = exercise starts at Tuesday 00:00 167 = exercise starts at Sunday 23:00 168 = exerciser off If a daily exercise is selected, then the day information is don't care and the exercise will be performed every day regardless of the day selection. If the monthly exerciser is selected, then the exercise will be performed during the first 7 days of each month at the programmed day and hour.

13.2. CONTROLLER CONFIGURATION GROUP (continued)

Parameter Definition	Unit	Factory Set	Description
Exercise Duration	min	10	This parameter defines the exercise duration and programmed in 10 minute steps up to 24 hours.
Exercise Off/On Load	-	0	**0:** Exercise **OFF LOAD** **1:** Exercise **ON LOAD**
Exercise Period	-	1	**0:** exercise every day (the exercise will be performed every day regardless of the day selection of Exercise Dat and Time parameter). **1:** exercise once per week **2:** exercise once per month (the exercise will be performed during the first 7 days of each month at the programmed day and hour).
Delayed Simulate Mains	-	0	**0: DISABLE AUTO START** input has normal function **1: DISABLE AUTO START** input has delayed simulate mains function. See chapter 6.7 for more info.
AMF / Remote Start Device	-	0	**0: AMF unit** (mains values are displayed) **1: Remote Start Unit**. (mains values are not displayed).
Modem Enable	-	0	**0:** The serial port is connected to PC **1:** Modem connected.
SMS Enable	-	0	**0:** SMS not enabled **1:** SMS enabled
RS-485 Enable	-	0	**0:** RS-232 comm port enabled **1:** RS-485 comm port enabled
MODBUS Address	-	0	**0:** RAINBOW communication protocol. **1-144:** MODBUS communication. This parameter is also the MODBUS controller address of the unit.
Oil Pressure in psi	-	0	**0:** oil pressure display in bars **1:** oil pressure display in psi
Low oil pressure switch priority	-	0	**0:** crank cut is performed through oil pressure switch and oil pressure sender reading **1:** crank cut is performed only through oil pressure switch
Flashing Relay Timer	hours	0	**Delayed Simulate Mains Operation:** max genset running time after Simulate Mains signal disappears. **Dual Genset Systems:** flashing relay toggle timer. Please contact DATAKOM for dual genset mutual stanby operation.
Real Time Clock Adjust	-	117	This parameter trims precisely the real time clock circuit. Values from 0 to 63 speed up the clock with 0.25sec/day steps. Values from 127 to 64 slow down the clock with 0.25sec/day steps.
Hysteresis Voltage	V	8	This parameter provides the mains and genset voltage limits with a hysteresis feature in order to prevent faulty decisions. For example, when the mains are present, the mains voltage low limit will be used as the programmed low limit. When the mains fail, the low limit will be incremented by this value. It is advised to set this value to 8 volts.

13.2. CONTROLLER CONFIGURATION GROUP (continued)

Parameter Definition	Unit	Factory Set	Description
RPM from genset frequency	-	1	This parameter is used in the conversion of the genset frequency to engine rpm. 0: read rpm from the optional MPU input 1: convert frequency to rpm (using crank teeth count)
Crank Teeth Count	-	30	This is the number of pulses generated by the magnetic pickup sensing unit in one turn of the flywheel. This parameter is also used in the conversion of the genset frequency to engine rpm. The frequency in Hz is multiplied with this parameter during conversion to rpm.
SMS on Mains Change	-	0	This parameter controls SMS sending when mains voltages status is changed. No warnings generated. **0:** no SMS when mains failed or restored **1:** SMS sent when mains failed or restored
Fuel Pump Low Limit	%	20	If the fuel level measured from the sender input falls below this level, then the FUEL PUMP function will become active.
Fuel Pump High Limit	%	80	If the fuel level measured from the sender input goes above this level, then the FUEL PUMP function will become passive.
Oil Press Sender Enable	-	1	0: Oil pressure sender not connected 1: Oil pressure warning and alarm enabled.
Engine Temp Sender Enable	-	1	0: Engine temp sender not connected 1: High engine temp warning and alarm enabled.
Fuel Level Sender Enable	-	1	0: Fuel level sender not connected 1: Low fuel level warning and alarm enabled.
Oil Temp Sender Enable	-	0	0: Oil temp sender not connected 1: High oil temp warning and alarm enabled.
Canopy Temp Sender Enable	-	0	0: Canopy temp sender not connected 1: High canopy temp warning and alarm enabled.
Oil pressure sender fault effect	-	0	0: no effect 1:warning 2:loaddump
Coolant temp sender fault effect	-	0	0: no effect 1:warning 2:loaddump
Fuel level sender fault effect	-	0	0: no effect 1:warning 2:loaddump
Oil temp sender fault effect	-	0	0: no effect 1:warning 2:loaddump
Canopy temp sender fault effect	-	0	0: no effect 1:warning 2:loaddump
Spare-2 sender fault effect (not active if the terminal is configured as sender ground)	-	0	0: no effect 1:warning 2:loaddump

13.2. CONTROLLER CONFIGURATION GROUP (continued)

Parameter Definition	Unit	Factory Set	Description
Enable Coolant Level AC Input	-	0	This parameter enables the Coolant Level AC Input. **0:** Coolant Level AC input not monitored **1:** Coolant Level AC input monitored
Disable Weekly timer	-	0	This parameter enables the Weekly Scedule Timer. **0:** Weekly Schedule Timer is enabled **1:** Weekly Schedule Timer is disabled
CT Location	-	0	**0:** Current transformers at alternator side **1:** Current transformers at load side
LCD Backlight Timer	hour	1	This parameter defines the period of LCD backlight is lighted-up and at the end of this period the LCD backlight will light out automatically. LCD backlight timer is restarted by pressing any of navigation pushbuttons or engine running state. When this parameter set to 0 the LCD backlight is lighted-up permanently.

13.3. ELECTRICAL PARAMETERS GROUP

Parameter Definition	Unit	Factory Set	Description
Current Transformer Ratio	A	500	This is the rated value of current transformers. All transformers must have the same rating. The secondary of the transformer will be 5 Amps.
Earth Leakage Current Transformer Ratio	A	500	This is the rated value of earth current transformer. The secondary of the transformer will be 5 Amps.
Overcurrent Limit	A	700	If the current goes above this limit, during the period defined in **Overcurrent Timeout** then a **Overcurrent Load Dump** alarm will be generated. If this parameter is 0 then Overcurrent check is disabled.
Excess Power Limit	KW	440	If the active power goes above this limit, during the period defined in Overload Timeout then an **Excess Power Load Dump** alarm will be generated. If this parameter is 0 then Excess Power check is disabled.
Overload Timeout	sec	5	This is the period between the active power goes over the limits and **EXCESS POWER** Load Dump alarm occur.
Mains Voltage Low Limit	V	180	If one of the mains phases goes under this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
Mains Voltage High Limit	V	260	If one of the mains phases goes over this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
Mains Frequency Low Limit	Hz	45	If the mains frequency goes under this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
Mains Frequency High Limit	Hz	55	If the mains frequency goes above this limit, it means that the mains are off and it starts the transfer to the genset in **AUTO** mode.
Genset Low Voltage Shutdown Limit	V	190	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **GENSET LOW VOLTAGE** shutdown alarm and the engine will stop.
Genset Low Voltage Warning Limit	V	200	If one of the generator phase voltages goes under this limit when feeding the load, this will generate a **GENSET LOW VOLTAGE** warning.
Genset High Voltage Warning Limit	V	250	If one of the generator phase voltages goes above this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** warning.
Genset High Voltage Shutdown Limit	V	260	If one of the generator phase voltages goes over this limit when feeding the load, this will generate a **GENSET HIGH VOLTAGE** alarm and the engine will stop.

13.3. ELECTRICAL PARAMETERS GROUP (continued)

Parameter Definition	Unit	Factory Set	Description
Low Battery Voltage Warning	V	19.0	If the battery voltage falls below this limit, this will generate a **LOW BATTERY** warning.
High Battery Voltage Warning	V	29.0	If the battery voltage goes over this limit, this will generate a **HIGH BATTERY** warning.
High Battery Voltage Shutdown	V	30.0	If the battery voltage goes over this limit, this will generate a **HIGH BATTERY** shutdown alarm and the engine will stop.
Mains Waiting Timer	min	0.5	This is the time between the mains voltages entered within the limits and the generator contactor is deactivated.
Genset Contactor Timer	sec	1	This is the period after the mains contactor has been deactivated and before the generator contactor has been activated.
Mains Contactor Timer	sec	1	This is the period after the generator contactor has been deactivated and before the mains contactor has been activated.
Mains Phase Order Enable	-	0	**0:** mains phase order checking disabled **1:** if mains phase order is faulty, then a warning is given and mains contactor deenergized.
Reverse power warning limit	kW	0	If the genset power is negative and goes above this limit then a **REVERSE POWER** warning will be generated.
Reverse power loaddumpg limit	kW	0	If the genset power is negative and goes above this limit then a **REVERSE POWER** loaddump will be generated.
Load Shedding Low Limit	kW	0	If the genset power goes below this limit then the load shedding relay will be deactivated.
Load Shedding High Limit	kW	0	If the genset power goes above this limit then the load shedding relay will be activated.
Genset Phase Order Loaddump	-	0	**0:** genset phase order checking disabled **1:** if genset phase order is faulty, then a loaddump is generated and the genset stops after cooldown.
Earth Leakage Current Warning Limit	%	0	If the earth current goes above this limit for earth fault timeout, then a warning will be generated. The value is defined as a percentage of genset CT rating.
Earth Leakage Current Loaddump Limit	%	0	If the earth current goes above this limit for earth fault timeout, then a loaddump alarm will be generated. The value is defined as a percentage of genset CT rating.
Earth Fault Delay	sec	5	If the earth current goes above limits during this period, an earth fault alarm will be generated.
Overcurrent Delay	sec	5	This is the period between the genset current goes over the limits and **OVERCURRENT** Load Dump alarm occur.
Genset Voltage Fail Delay	sec	5	This is the period between the genset voltage goes out of the limits and **HIGH VOLTAGE** or **LOW VOLTAGE** alarms occur.

13.4. ENGINE PARAMETERS GROUP

Parameter Definition	Unit	Factory Set	Description
Low Frequency Shutdown	Hz	47	If the genset frequency goes under this limit, a **GENSET LOW SPEED** alarm is generated and the engine stops.
Low Frequency Warning	Hz	48	If the genset frequency goes under this limit, a **GENSET LOW SPEED** warning is generated.
High Frequency Warning	Hz	54	If the genset frequency goes over this limit, a **GENSET HIGH SPEED** warning is generated.
High Frequency Shutdown	Hz	55	If the genset frequency goes over this limit, a **GENSET HIGH SPEED** alarm is generated and the engine stops.
Low Oil Pressure Warning	bar	1.5	If the oil pressure measured from the analog input falls below this limit, this will generate a **LOW OIL PRESSURE SENDER** warning.
Low Oil Pressure Shutdown	bar	1.0	If the oil pressure measured from the analog input falls below this limit, this will generate a **LOW OIL PRESSURE SENDER** alarm is generated and the engine stops.
High Temperature Warning	°C	95	If the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH TEMPERATURE SENDER** warning.
High Temperature Shutdown	°C	98	f the coolant temperature measured from the analog input goes over this limit, this will generate a **HIGH TEMPERATURE SENDER** alarm and the engine will stop.
Oil Pressure Sender type	-	1	This parameter selects the oil pressure sender type. **0:** Non standard sender. The sender characteristics are defined in **Sender Characteristics** table. **1:** VDO 0-7 bars (10-180 ohms) **2:** VDO 0-10 bars (10-180 ohms) **3:** DATCON 0-7 bars (240-33 ohms) **4:** DATCON 0-10 bars (240-33 ohms) **5:** DATCON 0-7 bars (0-90 ohms) **6:** DATCON 0-10 bars (0-90 ohms) **7:** DATCON 0-7 bars (75-10 ohms)
Coolant Temp. Sender Type	-	1	This parameter selects the temperature sender type: **0:** The sender characteristics are defined in **Sender Characteristics** table. **1:** VDO **2:** DATCON DAH type **3:** DATCON DAL type
Engine Heating Temperature	°C	0	If it is requested that the engine runs without load until reaching a certain temperature, this parameter defines the temperature. If the coolant temperature falls below this parameter, an **Engine Low Temperature** warning will occur.
Engine Start Delay	sec	0	This is the time between the mains fails and the fuel solenoid turns on before starting the genset. It prevents unwanted genset operation in battery backed-up loads.
Preheat Timer	sec	0	This is the time after the fuel solenoid is energized and before the genset is started. During this period the **PREHEAT** relay output is energized (if assigned by **Relay Definitions**)

13.4. ENGINE PARAMETERS GROUP (continued)

Parameter Definition	Unit	Factory Set	Description
Crank Timer	sec	10	This is the maximum start period. Starting will be automatically cancelled if the genset fires before the timer.
Wait Between Starts	sec	10	This is the waiting period between two start attempts.
Engine Heating Timer	sec	4	This is the period used for engine heating following the program parameter.
Cooldown Timer	min	1.0	This is the period that the generator runs for cooling purpose after the load is transferred to mains.
Stop Solenoid Timer	sec	10	This is the maximum time duration for the engine to stop. During this period the STOP relay output is energized (if assigned by **Relay Definitions**). If the genset has not stopped after this period, a **FAIL TO STOP** warning occurs.
Number of Starts	-	3	This is the maximum number of start attempts.
Choke Timer	sec	5	This is the control delay of CHOKE output. The choke output is activated together with the crank output. It is released after this delay or when engine runs (whichever occurs first).
Engine Heating Method	-	0	This parameter defines the engine heating method. The genset will not take the load before engine heating is completed. 0: engine is heated during Engine Heating Timer. 1: engine is heated until the coolant temperature reaches the Engine Heating Temperature and at least during the Engine Heating Timer.
Service Engine Hours	hour	250	The SERVICE REQUEST led indicator will turn on after this quantity of engine hours from the last service. If the period is set to ‘0’ no SERVICE REQUEST will be generated depending on engine hours.
Service Period	month	6	The SERVICE REQUEST led indicator will turn on after this amount of time from the last service. If the period is set to ‘0’ no SERVICE REQUEST will be indicated depending on time.
Idle Speed Timer	sec	10	When the engine runs, the Idle output relay function will be active during this timer.
Gas Solenoid Delay	sec	5	The gas solenoid of the gas engine will be opened after this delay during cranking.
Low Fuel Warning	%	20	If the fuel level measured from the analog input falls below this limit, a LOW FUEL LEVEL SENDER warning is generated.
Low Fuel Shutdown	%	10	the fuel level measured from the analog input falls below this limit, a LOW FUEL LEVEL SENDER shutdown alarm is generated and the engine stops.
Fuel Consumption per Hour	%	0	This parameter is used to calculate the fuel quantity in the fuel tank in engine-hours. This is also the threshold for sending FUEL THEFT and FUELLING sms messages. If this parameter is set to 0, then no Fuel Theft and Fuelling sms messages will be sent. Check chapter 6.19 for details of fuel theft SMS messages.
Fuel Tank Capacity	lts	0	This parameter is used to calculate the fuel quantity in the fuel tank. If this parameter is set to zero then the fuel quantity in liters will not be displayed.

13.4. ENGINE PARAMETERS GROUP (continued)

Parameter Definition	Unit	Factory Set	Description
Crank Cut Frequency	Hz	10.0	When the genset frequency reaches this limit, the engine is supposed running and the crank output will release.
Crank Stop with Oil Pressure	-	0	0: no crank stop with oil pressure 1: cranking is stopped when oil presure switch is open or the oil pressure measured is above shutdown limit.
Crank Stop with Charge	-	0	0: no crank stop with charge input 1: cranking is stopped when the charge alternator voltage is established.
Charge input connected	-	0	0: charge input not connected. 1: charge input connected.
Low rpm Shutdown	rpm	0	If the engine speed goes under this limit, a GENSET LOW SPEED alarm is generated and the engine stops.
Low rpm Warning	rpm	0	If the engine speed goes under this limit, a GENSET LOW SPEED warning is generated.
High rpm Warning	rpm	0	If the engine speed goes over this limit, a GENSET HIGH SPEED warning is generated.
High rpm Shutdown	rpm	0	If the engine speed goes over this limit, a GENSET HIGH SPEED alarm is generated and the engine stops.
Fan turn-on temp	°C	90	If the coolant temp is above this limit then the fan relay function will become active.
Fan turn-off temp	°C	80	If the coolant temp is below this limit then the fan relay function will become inactive.
High Oil Temperature Warning	°C	100	If the oil temperature measured from the analog input goes over this limit, this will generate a HIGH OILTEMPERATURE SENDER warning.
High Oil Temperature Shutdown	°C	120	f the oil temperature measured from the analog input goes over this limit, this will generate a HIGH OIL TEMPERATURE SENDER alarm and the engine will stop.
High Canopy Temperature Warning	°C	80	If the canopy temperature measured from the analog input goes over this limit, this will generate a HIGH CANOPY TEMPERATURE SENDER warning.
High Canopy Temperature Shutdown	°C	90	f the oil temperature measured from the analog input goes over this limit, this will generate a HIGH CANOPY TEMPERATURE SENDER alarm and the engine will stop.
Oil Temp. Sender Type	-	1	This parameter selects the temperature sender type: 0: The sender characteristics are defined in Sender Characteristics table. 1: VDO 2: DATCON DAH type 3: DATCON DAL type
Canopy Temp. Sender Type	-	1	This parameter selects the temperature sender type: 0: The sender characteristics are defined in Sender Characteristics table. 1: KOEL 2: VDO 3: KTY13-5 sensor

13.4. ENGINE PARAMETERS GROUP (continued)

Parameter Definition	Unit	Factory Set	Description
Genset Speed Fail Delay	Sec	5	This is the period between the frequency or revolution goes out of the limits and **OVERSPEED** or **UNDERSPEED** alarms occur.
4-20 mA Oil Pressure Sender Enable	-	0	0: Disable 4-20 mA Sender 1: Enable 4-20 mA Sender When the 4-20mA sender is enabled the primary oil pressure measurement source is switched to the terminal-16.
4-20 mA Sender 4mA pressure equivalent	bar	0.0	Pressure equivalent of 4mA when 4-20mA oil pressure sender is enabled.
4-20 mA Sender 20mA pressure equivalent	bar	10.0	Pressure equivalent of 20mA when 4-20mA oil pressure sender is enabled.

13.5. ADJUST DATE AND TIME

These parameters allow adjusting the battery backup real time clock of the module. Once set, the clock will continue to run even if DC power is removed from the unit.

Parameter Definition	Unit	Min	Max	Description
Date	-	01	31	Current day of the month.
Month	-	01	12	Current month.
Year	-	00	99	Last two digits of the current year.
Hours	-	00	23	Current hour of the day.
Minutes	-	00	59	Current minute of the hour.
Seconds	-	00	59	Current second of the minute.

13.6. DIGITAL INPUT CONFIGURATION

The unit has 8 digital inputs. By using external input extension modules, up to 24 inputs in total are available.

Input Configuration-01 (High Temperature Switch)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

Input Configuration-02 (Low Oil Pressure Switch)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		1	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

Input Configuration-03 (Emergency Stop)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		0	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

Input Configuration-04 (Force to Start)

Parameter Definition	Unit	Fac.Set	Description
Action		3	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		0	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

Input Configuration-05 (Low Fuel Switch Input)

Parameter Definition	Unit	Fac.Set	Description
Action		0	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		1	**0:** No delay **1:** Delayed (4sec)

Input Configuration-06 (Spare–1 Input)

Parameter Definition	Unit	Fac.Set	Description
Action		2	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		0	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

Input Configuration-07 (Spare-2 Input)

Parameter Definition	Unit	Fac.Set	Description
Action		2	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		0	**0:** Non latching **1:** Latching
Contact type		0	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

Input Configuration-08 (Low Coolant Level Input)

Parameter Definition	Unit	Fac.Set	Description
Action		3	**0:** Shutdown (the engine stops immediately) **1:** Load Dump (the engine stops after cooldown) **2:** Warning (the horn relay operates) **3:** No operation
Sampling		0	**0:** Always **1:** After holdoff timer **2:** When mains present
Latching		1	**0:** Non latching **1:** Latching
Contact type		1	**0:** Normally open **1:** Normally closed
Switching		0	**0:** Battery negative **1:** Battery positive
Response delay		0	**0:** No delay **1:** Delayed (4sec)

13.7. OUTPUT CONFIGURATION

The parameters below define the functions of digital outputs. The unit has 7 digital outputs. All outputs have programmable functions, selected from a list.

The relays may be extended up to 23 using **Relay Extension Modules**.

RELAY-1 function is always CRANK (not selectable).
RELAY-2 function is always FUEL (not selectable)

Parameter Def.	Factory Set	Description
RL-03	26: IDLE	RELAY-3 function selected from list
RL-04	03: STOP	RELAY-4 function selected from list
RL-05	01: ALARM	RELAY-5 function selected from list
RL-06	05: MAINS C.	RELAY-6 function selected from list
RL-07	04: GEN C.	RELAY-7 function selected from list

RL-08	0	RELAY-8 function (expansion module-1) selected from list
RL-09	2	RELAY-9 function (expansion module-1) selected from list
RL-10	4	RELAY-10 function (expansion module-1) selected from list
RL-11	5	RELAY-11 function (expansion module-1) selected from list
RL-12	0	RELAY-12 function (expansion module-1) selected from list
RL-13	2	RELAY-13 function (expansion module-1) selected from list
RL-14	4	RELAY-14 function (expansion module-1) selected from list
RL-15	5	RELAY-15 function (expansion module-1) selected from list

RL-16	0	RELAY-16 function (expansion module-2) selected from list
RL-17	2	RELAY-17 function (expansion module-2) selected from list
RL-18	4	RELAY-18 function (expansion module-2) selected from list
RL-19	5	RELAY-19 function (expansion module-2) selected from list
RL-20	0	RELAY-20 function (expansion module-2) selected from list
RL-21	2	RELAY-21 function (expansion module-2) selected from list
RL-22	4	RELAY-22 function (expansion module-2) selected from list
RL-23	5	RELAY-23 function (expansion module-2) selected from list

OUTPUT FUNCTION LIST

00	Fuel
01	Alarm
02	Start
03	Stop
04	Gen. Contactor
05	Mains Contactor
06	Choke
07	Preheat
08	Shutdown alarm
09	Shutdown or load_dump alarm
10	Shutdown or load_dump or warning
11	Automatic ready
12	Week. on time
13	Exerciser on
14	Load_dump alarm
15	-
16	Mains Fail
17	Block Heater
18	Service Request
19	-
20	Load Shedding Relay
21	Flashing Relay
22	Gas Solenoid
23	Fuel Pump
24	Mains Phase Order Fail
25	Genset Phase Order Fail
26	Idle Speed
27	Cooler Fan
28	-
29	-
30	-
31	-

32	IN_1 alarm
33	IN_2 alarm
34	IN_3 alarm
35	IN_4 alarm
36	IN_5 alarm
37	IN_6 Alarm
38	IN_7 Alarm
39	IN_8 Alarm
40	Oil sender alarm
41	Temp sender alarm
42	Low speed alarm
43	High speed alarm
44	Low voltage alarm
45	High voltagealarm
46	Fail to start alarm
47	Low fuel sender alarm
48	Oil Temp sender alarm
49	Canopy Temp sender alarm
50	-
51	High battery voltage alarm
52	Charge fail alarm
53	-
54	Coolant Level AC switch alarm
55	-
56	IN_1 load_dump
57	IN_2 load_dump
58	IN_3 load_dump
59	IN_4 load_dump
60	IN_5 load_dump
61	IN_6 load_dump
62	IN_7 load_dump
63	IN_8 load_dump
64	Oil sender fail ldd
65	Temp sender fail ldd
66	Fuel Lev sender fail ldd
67	Oil Temp snd fail ldd
68	Canopy Temp snd fail ldd
69	Spare-1 sender fail ldd (Not functional by the hardware version 07)
70	Spare-2 sender fail ldd
71	-
72	Overcurrent load_dump
73	Excess power ldd
74	Reverse power ldd
75	High Earth current ldd
76	Autostart lock out
77	-
78	-
79	Genset Phase Order Fail Loaddump

80	IN_1 warning
81	IN_2 warning
82	IN_3 warning
83	IN_4 warning
84	IN_5 warning
85	IN_6 warning
86	IN_7 warning
87	IN_8 warning
88	Oil sender warning
89	Temp sender warn.
90	Low speed warning
91	High speed warning
92	Autostart lock out
93	Low Temp snd warn.
94	Fail to stop warning
95	Low fuel sender warn.
96	Service request warn.
97	Mains Phase Order Fail warning
98	Low battery warning
99	High battery warning
100	Charge fail warning
101	-
102	-
103	High Earth Current warning
104	Gen Low voltge warn.
105	Gen High voltge warn.
106	Reverse Power warn.
107	High oil temp warn.
108	High canopy temp warning
109	-
110	Low coolant level AC switch warning
111	-
112	Oil sender fail warn
113	Temp sender fail warn
114	Fuel sender fail warn
115	Oil temp snd fail warn
116	Canopy temp snd fail warning
117	Spare-1 sender fail warning (Not functional by the hardware version 07)
118	Spare-2 sender fail warning
119	-

13.8. INPUT FUNCTION SELECTION

The parameters below define the functions of digital inputs, selected from a list.

Functions from 12 to 23 activate also the related operating sequence.

The related input configuration parameters apply for each input, thus any signal can be programmed for NO or NC contact, closing to BAT+ or BAT-.

Parameter Definition	Fact. Set	Description
Input 01 Function Select	1	High Temp. Switch
Input 02 Function Select	0	Oil Pressure Switch
Input 03 Function Select	4	Emergency Stop
Input 04 Function Select	20	Force to Start
Input 05 Function Select	7	Low Fuel Level Switch
Input 06 Function Select	11	Spare-1 Input
Input 07 Function Select	10	Spare-2 Input
Input 08 Function Select	2	Coolant Level Switch

INPUT FUNCTION SELECT LIST

Number	Description
0	Oil Pressure Switch
1	High Temp. Switch
2	Low Coolant Level switch
3	Rectifier Fail
4	Emergency Stop
5	Alternator High Temp.
6	Door Open
7	Low Fuel Level Switch
8	Earthquake Detector
9	Annunciator Mode Enable
10	Spare-2 Input
11	Spare-1 Input
12	Force AUTO Mode
13	Force OFF Mode
14	Force TEST Mode
15	Overload Input
16	By-Pass I/P Input
17	Priority Input
18	Remote Start Input
19	Disable Auto Start
20	Force to Start
21	Fault Reset
22	Alarm Mute
23	Panel Lock

13.9. SITE ID STRING

The site identity string is designed to identify the current controller.

This is the site Id string sent at the beginning of SMS messages, e-mails and web page headers for the identification of the genset sending the message. Any 20 character long string may be entered.

13.10. ENGINE SERIAL NUMBER

The engine serial number string is designed to identify the current controller.

Th s string is added to GSM-SMS messages, e-mails, web page headers etc. Any 20 character long string may be entered.

13.11. MODEM1-2/SMS1-2-3-4-5-6 TELEPHONE NUMBERS

These telephone number buffers accept up to 16 digits, including the wait character (“,”) in order to enable dialing through a pabx.

Depending of the setting of Modem Enabled parameter, fist 2 numbers may be modem or SMS telephone numbers. Last 4 numbers are always SMS numbers.

If Modem Enabled: First 2 telephone numbers are used for modem calls.
If Modem Disabled: All 6 numbers are used for SMS sending.

Enter numbers starting from first character. Do not leave blank characters at the beginning.

14. CRANK CUTTING

In order to insure fast and reliable crank cutting, the unit uses various resources for engine running condition detection.

Cranking is stopped when **at least one** of below conditions is met:

- Crank timer expired:

The crank timer is adjusted through **Engine Parameters > Crank Timer**. The maximum allowed timer is 15 seconds.

- Genset AC voltage over threshold:

If the genset phase L1 AC voltage reaches 100VAC, then cranking is immediately stopped.

- Genset frequency over threshold:

If the genset phase L1 frequency reaches **Engine Parameters > Crank Cut Frequency**, then cranking is immediately stopped.

- Genset rpm over threshold:

If the genset rpm reaches 300rpm, then cranking is immediately stopped.

- Charge alternator voltage over threshold

Following setting is necessary: **Engine Parameters > Charge Input Connected = 1, Engine Parameters > Crank Stop with Charge=1**.

If the charge alternator voltage is established, then cranking is immediately stopped.

- Oil pressure above threshold

Following setting is necessary: **Engine Parameters > Crank Stop with Oil Pressure = 1**

The crank cutting with oil pressure has a factory set delay of 2 seconds.

Both low oil pressure switch and oil pressure sender readings may be used for crank cutting. The oil pressure switch is always used. The sender may be disabled through **Controller Configuration > Oil Pressure Switch Priority** parameter.

If enabled, when oil pressure is detected, cranking is stopped after delay.

15. SOFTWARE FEATURES

15.1. Remote Start Operation

The unit offers the possibility of **Remote Start** mode of operation. Any digital input may be assigned as **Remote Start Input** using **Input Function Select** program parameters.

The **Remote Start** signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using programming menu.

It is also necessary to set the **ACTION** program parameter of the related input to **3** in order to prevent any alarm from this input.

When a **Remote Start** input is defined, if mains phases are inside limits then the engine will never run. If mains phases are out of limits then if the REMOTE START signal is present then the engine will run. The front panels mimic diagram's mains LEDs will always reflect the status of the **Remote Start** input.

15.2. Disable Auto Start, Simulate Mains

The unit offers an optional **Disable Auto Start** signal input. Any digital input may be assigned as **Disable Auto Start** using **Input Function Select** program parameters**.**

It is also necessary to set the **ACTION** program parameter of the related input to **3** in order to prevent any alarms generated from this input.

The **Disable Auto Start** signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using the programming menu.

If the **Disable Auto Start** input is defined and the input signal is active, the mains phases are not monitored and supposed to be inside limits. This will prevent the genset from starting even in case of a mains failure. If the genset is running when the signal is applied, then usual Mains Waiting and Cooldown cycles will be performed before engine stop. When the **Disable Auto Start** signal is present, the front panels mimic diagram's mains LEDs will reflect the mains voltages as present.

When the signal is passive, the unit will revert to normal operation and monitor the mains voltage status.

The REMOTE START operation overrides DISABLE AUTO START and FORCE TO START operations.

15.3. Battery Charging Operation, Delayed Simulate Mains

The Delayed Mains Simulation feature is used in battery backed up telecom systems where batteries are able to supply the load during a certain period. The genset is requested to run only when battery voltage drops below the critical level. Once the engine runs, the rectifier system starts charging the batteries and the battery voltage goes up immediately. Thus the engine should continue to run a programmed period for effective charging. The critical battery voltage level will be detected by an external unit which provides the digital **Disable Auto Start** signal for the genset control unit.

The unit offers an optional **Disable Auto Start** signal input. Any digital input may be assigned as **Simulate Mains** using **Input Function Select** program parameters**.**

It is also necessary to set the **ACTION** program parameter of the related input to **3** in order to prevent any alarms generated from this input.

The **Disable Auto Start** signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using the programming menu.

If the **Delayed Simulate Mains** program parameter is set to 1 and the input signal is active when the genset is not feeding the load, the mains phases are not monitored and supposed to be inside limits. This will prevent the genset from starting when the simulate mains signal is present (batteries charged). The genset will start when mains voltages are out of limits and the simulate mains signal not present.

If the genset is running when the signal is applied, then MAINS SIMULATION will be prevented during **Flashing Relay Timer** program parameter. After this, usual Mains Waiting and Cooldown cycles will be performed before engine stop. When the SIMULATE MAINS signal is present, the front panels mimic diagram's mains LEDs will reflect the mains voltages as present.

When the signal is passive, the unit will revert to normal operation and monitor the mains voltage status.

The REMOTE START operation overrides Disable Auto Start operation. When both "Remote Start Operation" and "Delayed Simulate Mains" are enabled then REMOTE START operation mode is performed.

15.4. Dual Genset Mutual Standby Operation

Dual genset intermittent operation consists of regular switching of the load between 2 gensets. The use of 2 gensets instead of one is due either to safety purposes in case of a genset failure or to a continuous operation requesting service stops.

The running period for each genset is adjustable using **Flashing Relay Timer** program parameters. If the time is adjusted as 0 hours, it will be actually set to 2 minutes for faster testing purposes.

A flashing relay output function is provided, based on the parameter **Flashing Relay Timer**. Each time the period programmed using **Flashing Relay Timer** elapses, the relay output will change position.

The flashing relay function may be assigned to any digital output using **Output Configuration** program parameters.

The dual genset intermittent operation uses also the **Disable Auto Start** feature. Please review related chapter for a detailed explanation of this feature.

Priority In Dual Genset Mutual Standby Operation:

It may be required that the dual genset system starts the same genset at every mains failure. This is achieved using the PRIORITY input.

Any digital input may be assigned as **Priority** using **Input Function Select** program parameters**.**

It is also necessary to set the **ACTION** program parameter of the related input to **3** in order to prevent any alarms generated from this input.

The **Priority** signal may be a NO or NC contact, switching to either battery positive or battery negative. These selections are made using the programming menu.

If a **Priority** input is defined, then the system will work in priority mode. If the priority signal is applied, the unit will become master after each mains failure. If the priority signal is not applied, then the unit will become the slave one and the other genset will start.

Please contact DATAKOM for a complete application manual.

15.5. External Control of the Unit

The unit offers total external control through programmable digital inputs. Any digital input may be programmed for below functions:

- Force STOP mode
- Force AUTO mode
- Force TEST mode
- Disable Auto Start
- Force to Start
- Fault Reset
- Alarm Mute
- Panel Lock

External mode select signals have priority on mode buttons of the unit. If the mode is selected by external signal, it is impossible to change this mode with front panel pushbuttons. However if the external mode select signal is removed, the unit will revert to the last selected mode via pushbuttons.

It is also possible to lock the front panel completely for remote command.

15.6. Automatic Exerciser

The unit offers automatic exerciser operation. The exercise operation may be done on a daily, weekly or monthly basis.

The start day and time of the exercise is programmable as well as its duration. The exercise may be done with or without load following programming.

Program parameters related to the exerciser are:

Exercise start day and hour

Exercise duration

Exercise off_load / on_load

Exerciser can only be enabled through PC. It cannot be programmed from front panel.

When the start day and hour of exercise has come, the unit will automatically switch to either **RUN** or **TEST** mode. The engine will run. If the on_load exercise is selected then the load will be transferred to the genset.

If a mains failure occurs during the off-load exercise, the load will not be transferred to the genset unless the **Emergency Backup Operation** is allowed by setting the related program parameter to 1. Thus it is highly recommended that the Emergency Backup mode enabled with off-load exerciser.

At the end of the exercise duration, the unit will switch back to the initial mode of operation.

If any of the mode selection keys are pressed during exercise, then the exercise will be immediately terminated.

Using the daily exercise mode, the unit may feed the load from the genset during predefined hours of the day. This operation may be used in high tariff periods of the day.

15.7. Weekly Operation Scheduler

In most applications, the genset is requested to operate only in working hours. Thanks to the weekly program feature, unwanted operation of the genset may be prohibited.

The scheduler is active only in **AUTO** mode. When the scheduler prevents genset operation in AUTO mode, the **AUTO** led will flash.

When the scheduler prevents genset operation in AUTO mode, the AUTO led will flash.

The scheduler consists of 144 programmable parameters, one for each hour in a week. Thus every hour of the week may be independently selected as ON or OFF times.

These programmable parameters allow the genset to operate automatically only in allowed time limits.

The unit has a battery backed-up precision real time clock circuit. The real time clock circuit will continue its operation even in power failures. The real time clock is precisely trimmed using the **Real Time Clock Adjust** program parameter. For more details check the programming section.

15.8. Engine Heating Operation

Especially on engines without a body heater, or with a failing one, it may be desired that the genset should not take the load before reaching a suitable temperature. The unit offers 2 different ways of engine heating.

1. Timer controlled heating:

This operation mode is selected when the **Engine Heating Method** parameter is set to **0**. In this mode, the engine will run during parameter **Engine Heating Timer**, and then the genset will take the load.

2. Timer and temperature controlled heating:

This operation mode is selected when the **Engine Heating Method** parameter is set to **1**. In this mode, at first the engine will run during parameter **Engine Heating Timer**, then it will continue to run until the measured coolant temperature reaches the limit defined in parameter **Engine Heating Temperature**. When the requested temperature is reached, the load will be transferred to the genset. This operation mode may be used as a backup to the engine body heater. If the engine body is warm the heating will be skipped.

15.9 Engine Idle Speed Operation

It may be required that the engine runs at the idle speed for a programmed duration for engine heating. The idle operation duration is adjusted with the parameter **Idle Speed Timer**. The idle speed will be set by the governor control unit of the engine.

Any digital output may be assigned as **IDLE output** using **Relay Definition** program parameters.

The Idle speed operation is performed both in engine start-up and cool-down sequences. Low speed and low voltage protections are disabled during idle speed operation.

15.10. Engine Block Heater

The unit is able to provide a digital output in order to drive the block heater resistor. The temperature reference is the coolant temperature measured from the analog sender input.

The block heater output function may be assigned to any digital output using **Relay Definition** program parameters.

The engine body temperature limit is adjusted using the parameter **Engine Heating Temperature**. The same parameter is used for engine heating operation.

The relay will become active if the body temperature falls to 4 degrees below the limit set by **Engine Heating Temperature**. It turns off when the body temperature exceeds **Engine Heating Temperature**.

15.11. Fuel Pump Control

The unit is able to provide a digital output function in order to drive the fuel pump motor. The fuel pump is used in order to transfer fuel from the large capacity main tank (if exists), to the genset daily tank which is generally integrated in the chassis and has a limited capacity.

The fuel level reference is measured through the analog fuel level sender. When the measured fuel level falls below **Fuel Pump Low Limit** parameter, the fuel pump output function will become active. When the fuel level reaches **Fuel Pump High Limit** parameter, the output function will become passive. Thus the chassis fuel tank level will be always kept between **Fuel Pump Low Limit** and **Fuel Pump High Limit** parameters.

The fuel pump relay function may be assigned to any digital output using **Relay Definition** program parameters.

15.12. Gas Engine Fuel Solenoid Control

The unit provides a special function for the fuel solenoid control of a gas engine.

The fuel solenoid of a gas engine is different from a diesel engine. It should be opened after the cranking has been started and should be closed between crank cycles. The delay between the crank start and solenoid opening is adjusted using the **Gas Solenoid Delay** program parameter.

The gas engine fuel solenoid relay function may be assigned to any digital output using **Relay Definition** program parameters.

15.13. Load Shedding / Dummy Load

The load shedding feature consists on the disconnection of the least crucial loads when the genset power approaches to its limits. These loads will be supplied again when the genset power falls below the programmed limit. The internal Load Shedding function is always active. Any digital output may be used as the load shedding output.

The dummy load function consists on the connection of a dummy load if the total genset load is below a limit and to disconnection of the dummy load when the total power exceeds another limit. The dummy load function is the inverse of the load shedding function, thus the same output may be used for both purposes.

It is also possible to control more complex external systems with multiple steps, using LOAD_ADD and LOAD_SUBSTRACT output functions. Any digital output may be assigned to these signals.

When the load is below the Load Shedding Low Limit, the controller will activate the Load Add output. The external system will increase the load until it goes over the low limit, where the Load Add output will become inactive.

When the load is above the Load Shedding High Limit, the controller will activate the Load Substract output. The external system will decrease the load until it goes below the high limit, where the Load Substract output will become inactive.

There are protection delays between two pulses.

The parameters used in Load Shedding feature are in the Electrical Parameters Group:

Parameter Definition	Unit	Min	Max	Factory Set	Description
Load Shedding Low Limit	kW	0	65000	0	If the genset power goes below this limit then the load shedding relay will be deactivated.
Load Shedding High Limit	kW	0	65000	0	If the genset power goes above this limit then the load shedding relay will be activated.

15.14. 4-20mA Oil Pressure Measurement

The unit has an additional 4-20 mA oil pressure input that can be used instead of the resistive sender input.

4-20 mA sender parameters are placed in **ENGINE PARAMETERS** group. It is possible to configure the pressure values for 4 and 20mA enabling the use of various products.

The 4-20mA sensor has priority, thus when the 4-20 mA oil pressure sensor is enabled, the measurement coming from the 4-20mA sensor will replace the oil pressure measurement coming from the resistive sender input.

The “OIL PRESSURE SENDER FAULT” parameter will define the alarm level caused by the misconnection of the 4-20 mA sensor.

15.15. Modem Connection

The unit is capable of making modem calls in case of alarm, as well as answering modem calls made from a remote location. **GSM** modems and classic cable network (**PSTN**) modems are acceptable.

If the modem is connected to the unit, the **Modem Enable** program parameter should be set to 1, otherwise faulty operation may occur.

A maximum of 2 telephone numbers can be defined for outgoing modem calls. In case of alarm, the unit will attempt to reach control centers associated with each number. In case of modem connection failure, the call will be repeated up to 30 times with 2 minute intervals.

When the modem call is in progress, a telephone icon ( ) will appear at the upper right corner of the screen.

If **Modem Enable** or **SMS Enable** or **MODBUS Address** or **RS-485 Enable** parameters are different from zero, the local PC connection will not work.

Advised modems are DATAKOM types which are powered up from the same DC battery voltage than the unit. Most of other desktop modems with standard AT commands are also usable, but it is the user's responsibility to provide an uninterrupted AC supply source to the modem. The necessary modem cable will be supplied by DATAKOM.

Modem calls are always terminated by the central RAINBOW software. However the unit does not allow connection durations exceeding 2 minutes, and hangs up the modem when this period expires.

The PC program used for remote monitoring and programming is the same RAINBOW software used for RS-232 connection.

Please note that the modem operation is also compatible with the MODBUS communication. Thus the unit can iniate and receive calls to/from a MODBUS master station. Please review chapter "**MODBUS SUPPORT**" for more details on MODBUS communication.

15.16. SMS Message Sending

The GSM SMS sending is activated by setting the **SMS Enable** program parameter to **1**.

If **Modem Enable** or **SMS Enable** or **MODBUS Address** or **RS-485 Enable** parameters are different from zero, the local PC connection will not work.

When a fault condition occurs, the unit will compose an SMS message and will send it to up to 6 phone numbers. If modem is enabled, only 4 telephone numbers are available for SMS sending.

The unit is also able to send SMS messages in below conditions, without creating a visible alarm or warning:

Mains Fail, Mains Restored (enabled via **SMS on Mains Change** program parameter)

Fuel Theft, Fuelling (enabled by setting the **Fuel Consumption / Hour** parameter to other than 0)

If both modem and SMS are enabled, the unit will send SMS messages first and attempt modem connection afterwards.

When SMS sending is in progress, an (**SMS**) icon will appear at the upper right corner of the screen.

The maximum number of alarms transmitted in a SMS message is 4. This limitation is due to the maximum length of an SMS message which is 160 characters.

A sample GSM SMS message is given below:

KOEL <SITE-ID>
STOP :LOW OIL PRESSURE SW.
END OF ALARM LIST

The first line of the message carries information about the unit type and the site identity string. This line is intended for the identification of the genset sending the SMS message.

Each following line will give one fault information. The message will always be terminated by the "**END OF ALARM LIST**" string.

When the message is sent, the existing alarms will be masked, causing the audible alarm relay to release and preventing consecutive GSM SMS messages. Any new upcoming alarm will result in a new GSM SMS message. The new message will indicate all existing alarms, even masked ones.

The necessary GSM modem cable will be supplied by DATAKOM. This is the same cable as PSTN (land) modems.

15.17. Remote Monitoring and Programming

Thanks to its standard serial RS-232 port, the unit offers the remote monitoring and programming feature.

The remote monitoring and programming PC software is called RAINBOW and may be downloaded from **www.datakom.com.tr** internet site with **password login**.

The modem, SMS and Modbus modes are not compatible with the local PC connection. **Modem Enable**, **SMS Enable** and **MODBUS Address** program parameters should be set to 0 before connection.

The RAINBOW software allows the visualization and recording of all measured parameters. The recorded parameters may then be analyzed graphically and printed. The software also allows the programming of the unit and the storage of the program parameters to PC or the downloading of stored parameters from PC to the unit.

The necessary PC connection cable will be supplied by DATAKOM.

For PCs without a serial port, below USB to serial adapters are tested and approved :

DIGITUS USB 2.0 TO RS-232 ADAPTER (PRODUCT CODE: DA70146 REV 1.1)

DIGITUS USB 1.1 TO RS-232 ADAPTER (PRODUCT CODE: DA70145 REV 1.1)

FLEXY USB 1.1 TO SERIAL ADAPTER (PRODUCT CODE BF-810)

CASECOM USB TO SERIAL CONVERTER (MODEL: RS-01)

15.18. Fuel Theft / Fuelling Messages

The unit is able to send SMS messages in fuel theft or fuelling conditions.

These SMS messages are sent without creating visible fault condition.

These features are enabled by setting the program parameter **Engine Parameters > Fuel Consumption / Hour** to a value other than 0%.

The **Fuel Consumption / Hour** parameter should be set to a value clearly greater than the maximum fuel consumption of the engine.

If the fuel level measured from the sender input is decreased more than **twice this parameter** in 1 hour period, then a FUEL THEFT sms message is sent to programmed telephone numbers.

If the fuel level measured from the sender input is increased more than this parameter in 1 hour period, then a FUELLING sms message is sent to programmed telephone numbers.

15.19. Firmware Update

The unit offers possibility of updating the firmware in the field. The firmware is updated through the RS-232 serial port using Rainbow or a special DOS program.

The unit will go to firmware download mode with a special command from the PC program. In download mode, the display of the unit will show "**DL-01**"

During firmware update process, the progress is visible through a completion bar on the screen.

The firmware update operation will take around 3 minutes.

After completion of the update a special command will set back the unit to normal operation mode.

16. MODBUS SUPPORT

The unit offers the possibility of MODBUS communication via its RS232 serial port.

The connection to the MODBUS master may be done in 3 ways:

1) RS232 connection using directly the RS232 port provided.
2) RS422/485 connection using external RS422/485 converter.
3) Modem connection using external modem.

The MODBUS mode is activated by assigning a controller address to the unit using **MODBUS Address** program parameter. The possible address range is 1 to 144. Setting the address to 0 will **disable** the MODBUS mode and allow communication under RAINBOW protocol.

The MODBUS properties of the unit are:

-Data transfer mode: RTU

-Serial data: 9600 bps, 8 bit data, no parity, 1 bit stop

-Supported functions:

-Function 3 (Read multiple registers)

-Function 6 (Write single register)

Detailed description about the MODBUS protocol is found in the document "**Modicon Modbus Protocol Reference Guide"**. The web address is: www.modbus.org/docs/PI_MBUS_300.pdf

Below is a limited shortlist of readable registers. For the detailed **Modbus Application Manual** and a complete list of registers please contact DATAKOM.

ADDRESS (hex)	R / W	DATA SIZE	COEFFICIENT	DESCRIPTION
0000	R	16bit	x1	Mains Phase L1 voltage
0001	R	16bit	x1	Mains Phase L2 voltage
0002	R	16bit	x1	Mains Phase L3 voltage
0003	R	16bit	x1	Genset Phase L1 voltage
0004	R	16bit	x1	Genset Phase L2 voltage
0005	R	16bit	x1	Genset Phase L3 voltage
0006	R	16bit	x1	Genset Phase L1 current
0007	R	16bit	x1	Genset Phase L2 current
0008	R	16bit	x1	Genset Phase L3 current
000C	R	16bit	x1	Mains Phase L12 voltage
000D	R	16bit	x1	Mains Phase L23 voltage
000E	R	16bit	x1	Mains Phase L31 voltage
000F	R	16bit	x1	Genset Phase L12 voltage
0010	R	16bit	x1	Genset Phase L23 voltage
0011	R	16bit	x1	Genset Phase L31 voltage
0012	R	16bit	x10	Mains frequency
0013	R	16bit	x10	Genset frequency
0016-0017	R	32bit	x256	Genset active power: this 24 bit signed register holds the genset active power multiplied by 256. Least significant 16 bits are in the register 0016h. Most significant 8 bits are in the LSB of the register 0017h.
0018	R	8bit	x100	Power factor multiplied by 100 (signed byte). Negative values indicate a capacitive power factor.
002A	R	16bit	x1	Engine speed (rpm)
002B	R	16bit	x10	Oil pressure in bars.
002C	R	16bit	x1	Coolant temperature in degrees C.
002D	R	16bit	x1	Fuel level as %
002F	R	16bit	x10	Battery voltage
003D	R	8bit	-	Operating mode bit_3: manual mode bit_4: auto mode bit_5: off mode bit_6: run mode bit_7: test mode

17. DECLARATION OF CONFORMITY

The unit conforms to the EU directives
-2006/95/EC (low voltage)
-2004/108/EC (electro-magnetic compatibility)
Norms of reference:
EN 61010 (safety requirements)
EN 61326 (EMC requirements)

The CE mark indicates that this product complies with the European requirements for safety, health environmental and customer protection.

UL / CSA Conformity:

certification teting in progress
UL 508, Edition 17
UL 2200, 1st Edition.
UL 840 Edition 3
CSA C22.2 NO. 14 - Edition 10

18. MAINTENANCE

DO NOT OPEN THE UNIT !

There are NO serviceable parts inside the unit.

Wipe the unit, if necessary with a soft damp cloth. Do not use chemical agents

19. DISPOSAL OF THE UNIT

Following **DIRECTIVE 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on waste electrical and electronic equipment (WEEE)**, this unit should be stored and disposed separately from the usual waste.

20. ROHS COMPLIANCE

The european ROHS directive restricts and prohibits the use of some chemical materials in electronic devices.

Following the "**DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment",** this product is listed in annex-I under category: "**Monitoring and control instruments including industrial monitoring and control instruments**" and exempted from ROHS directive.

However Datakom is not using any ROHS uncompliant electronic components in the production. Only the solder contains lead. The switching to unleaded solderin is in progress.

21. TROUBLESHOOTING GUIDE

Below is a basic list of most often encountered troubles. More detailed investigation may be required in some cases.

The genset operates while AC mains are OK or continues to operate after AC mains are OK:

-Check engine body grounding.
-AC mains voltages may be outside programmed limits, measure the phase voltages.
-Check the AC voltage readings on the screen.
-Upper and lower limits of the mains voltages may be too tight. Check the parameters **Mains Voltage Low Limit** and **Mains Voltage High Limit**. Standard values are 170/270 volts.
-The hysteresis voltage may be given to excessive. The standard value is 8 volts.

AC voltages or frequency displayed on the unit are not correct:

-Check engine body grounding, it is necessary.
-The error margin of the unit is +/- 2 volts.
-If there are faulty measurements only when the engine is running, there may be a faulty charging alternator or voltage regulator on the engine. Disconnect the charging alternator connection of the engine and check if the error is removed.
-If there are faulty measurements only when mains are present, then the battery charger may be failed. Turn off the rectifier fuse and check again.

kW and cosΦ readings are faulty although the Amp readings are correct:

-Current transformers are not connected to the correct inputs or some of the CTs are connected with reverse polarity. Determine the correct connections of each individual CT in order to obtain correct KW and cosΦ for the related phase, and then connect all CTs. Please review chapter "**AC CURRENT INPUTS**"

Short circuit outputs of unused Current Transformers.

When the AC mains fails the unit energizes the fuel solenoid, but does not start and OIL PRESSURE EXISTS ! message is displayed:

The unit is not supplied with battery (-) voltage at the oil pressure input.
-Oil pressure switch not connected.
-Oil pressure switch connection wire cut.
-Oil pressure switch faulty.
-Oil pressure switch closes too lately. If oil pressure switch closes, the unit will start. Optionally oil pressure switch may be replaced.

The engine does not run after the first start attempt, then the unit does not start again and OIL PRESSURE EXISTS ! message is displayed:

-The oil pressure switch closes very lately. As the unit senses an oil pressure, it does not start. When oil pressure switch closes the unit will start. Optionally the oil pressure switch may be replaced.

When the AC mains fails, the engine starts to run but the unit gives START FAIL alarm and then the engine stops:

-The generator phase voltages are not connected to the unit. Measure the AC voltage between terminals **GEN L1-L2-L3** and **Generator Neutral** at the rear of the unit while the engine is running. A fuse protecting the generator phases may be failed. A misconnection may be occurred. If everything is OK, turn all the fuses off, and then turn all the fuses on, starting from the DC supply fuse. Then test the unit again.

The unit is late to remove engine cranking:

-The generator voltage rises lately. Also the generator remnant voltage is below 15 volts. The unit removes starting with the generator frequency, and needs at least 15 volts to measure the frequency.
-The unit is also able to cut cranking from charge alternator voltage and oil pressure input. Please read chapter "**CRANK CUTTING**"

The unit is inoperative:

Measure the DC-supply voltage between terminals BAT+ and BAT- at the rear of the unit. If OK, turn all fuses off, then turn all the fuses on, starting from the DC supply fuse. Then test the unit again.

Some program parameters are skipped:

These parameters are reserved for factory setting and cannot be modified.

AUTO led flashes and the genset does not run when mains fail:

The unit is in Weekly Schedule **OFF** time. Please check date and time setting of the unit. Please check also Weekly Schedule program parameters.

The genset runs but does not take the load:

Check that the genset Yellow led is on steadily. Adjust genset voltage and frequency limits if necessary.
Check that the digital output-8 is configured as "**Genset Contactor**"
Check "**Genset Contactor Timer**" program parameter.
Check that a Genset Loading Inhibit input signal is not active. Check input functions. If an input is configured as "**Genset Loading Inhibit**" then check the signal is not present at this input.